revealing the invisible

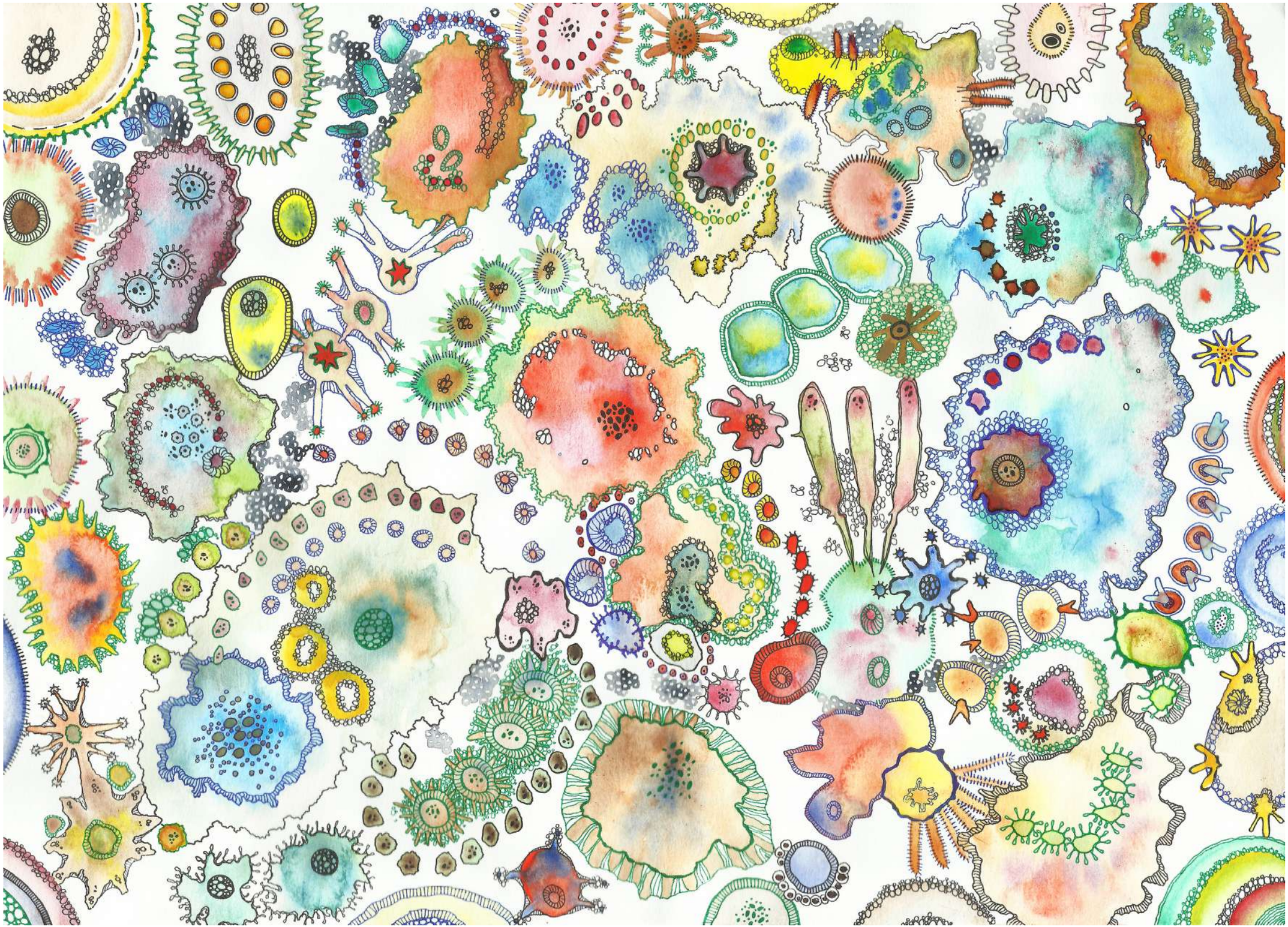
INSTITUTE FOR DISEASE AWARENESS,

Free State Psychiatric Complex, Oranjesig, Bloemfontein.

reveal

Laura-Anne Fox | 2010017529

The limitations of our vision are far from the limitations of existence...
life is so much more than meets the eye.



This dissertation is submitted in partial fulfilment of the requirements for the degree M. Arch. (Prof). All the work contained in this document is my own except where otherwise acknowledged.

Department of Architecture, Faculty of Natural and Agricultural Sciences,
University of the Free State.

Laura-Anne Fox | 2010017529 | iamlauraannefox@gmail.com

Supervisors:
Prof. J. D. Smit, Messrs. J. W. Ras; H.B. Pretorius; J. I. Olivier; H. Raubenheimer.

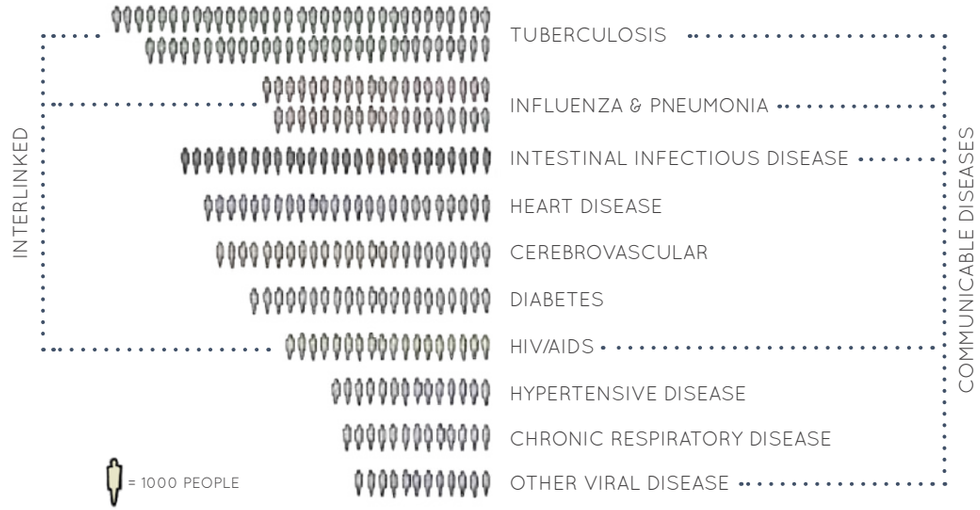
Date of submission:
22 September 2015.

Declaration of original authorship:
The work contained in this dissertation has not been previously submitted to meet requirements for an award at this or any other institution of higher education. To the best of my knowledge, this dissertation contains no material previously published or written by another person except where due reference is made.

Acknowledgement of editorial and proof-reading services:
The work contained in this dissertation has been submitted for proof-reading and editing by Ms W. Verster and Ms H. Human.

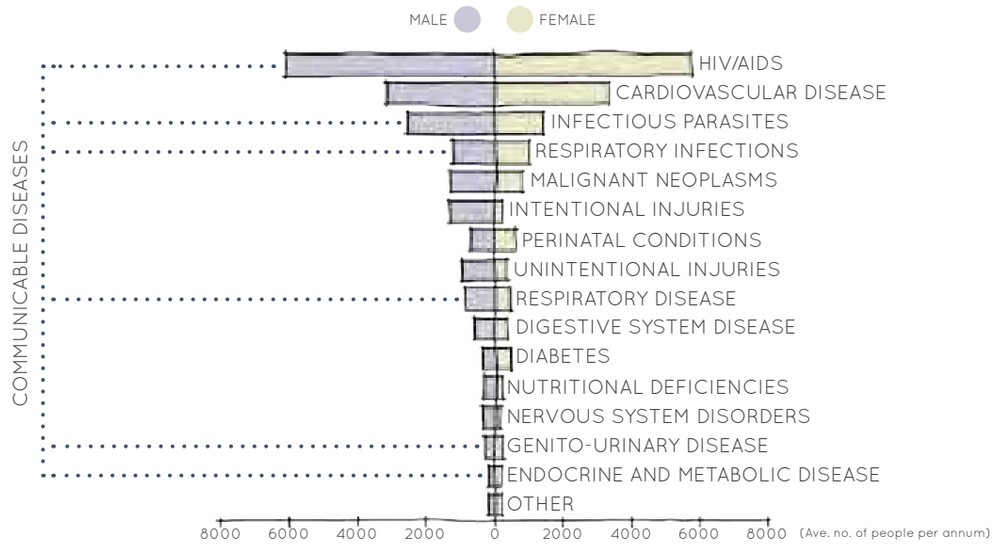
LEADING NATURAL CAUSES OF DEATH IN SOUTH AFRICA (2014)

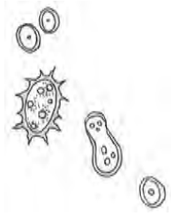
(Source: www.beta2.statssa.gov.za/ - accessed 27 January 2015)



LEADING CAUSES OF DEATH IN THE FREE STATE (2000-2010)

(Source: www.mrc.ac.za/ bod/ freestate.pdf - accessed 27 January 2015)





PREAMBLE

An Institute for Disease Awareness is proposed as a branch of the National Institute for Communicable Diseases (NICD), on the grounds of the Free State Psychiatric Complex in Oranjesig, Bloemfontein. The aim of this project is to provide a central institute to contribute to and facilitate effective communication between the NICD and organisations involved to combat the spread of infectious diseases and halt epidemics. The focus of this dissertation arose from an interest in the effect and management of disease control within the South African context. The research reported in this document sets out to investigate the role that architecture can play in contributing towards managing this problem that has so ravaged both the social and economic spheres of southern Africa and across the globe, and is intended to explore whether architecture of this nature is able to transcend the boundaries enforced by the regimentation of function, to become more empathetic to sensitive social issues and paradigms that exist within the public realm.

This dissertation will first identify certain problem statements, design challenges and project parameters, and will then move towards exploring and grounding these aspects as identified through research, analysis, and the review and interpretation of theoretical literature. These conceptual constructs and the information extrapolated from it will then be incorporated to create a synthesis with design and technical considerations. Lastly, this dissertation seeks to evaluate this synthesis by reflecting on and contemplating the success of the project in terms of its different components and aims.

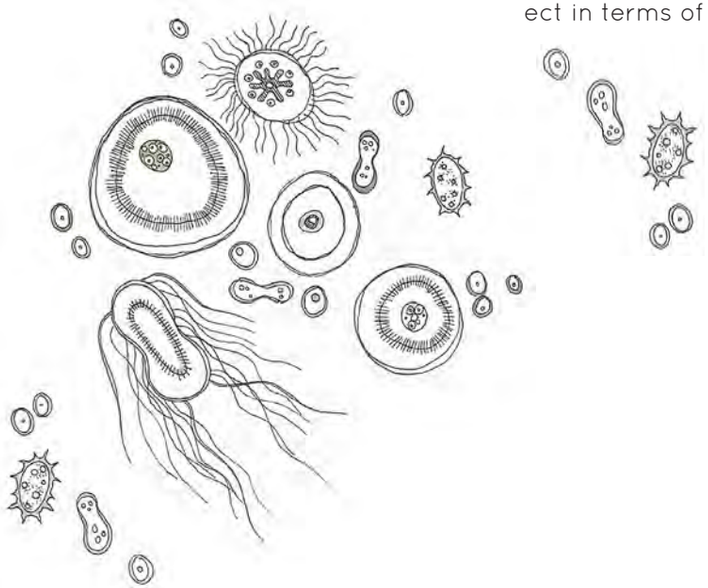


TABLE OF CONTENTS

- **Introduction** vi
- **Document framework** viii
- **Research designs** ix

1.1. Typology 2
1.1.1. Client and users 2
1.1.2. Initial brief 3
1.1.3. Problem statement 3
1.1.4. Aims 3

1.2. Topology 4
1.2.1. Problem statement 5
1.2.2. Aims 5

1.3. Morphology 6
1.3.1. Problem statement 6
1.3.2. Aims 6

1.4. Tectonics 7
1.4.1. Problem statement 7
1.4.2. Aims 7

PART 1
PROBLEM STATEMENTS AND AIMS (pg. 1)

PART 2
EXPLORATION AND GROUNDING (pg. 9)

2.1. Touchstone 10
2.2. Formative conceptual ideas 14
2.3. Conceptual framework: a glossary 20

2.4. Typology 22
2.4.1. Investigating the client and user 22
2.4.2. Exploring similar building-types 24
2.4.2.1. *Quality Control Laboratory for the Biovac Institute* 26
2.4.2.2. *National Tuberculosis Reference Laboratory* 32
2.4.2.3. *Institute of Infectious Disease and Molecular Medicine* 38
2.4.2.4. Case study: experience of a local microbial laboratory 46
2.4.3. Accommodation list and list of users 54

2.5. Topology 58
2.5.1. History of the context 58
2.5.2. The corner predicament 62
2.5.3. Wasted space 64
2.5.4. Quantitative site analysis 66
2.5.5. Cognitive/qualitative site analysis 35
2.6. Morphology 74
2.6.1. Identifying a unique approach 84
2.6.2. Morphological precedent: *A Productive Republic* 84
2.6.3. Discourse: grounding a unique approach through theoretical exploration 89
2.7. Tectonics 116
2.7.1. Structural concept exploration 116
2.7.2. Technical investigation 118
2.7.2.1. Overview 118
2.7.2.2. The site 118
2.7.2.3. Unique requirements for microbial laboratories 122
2.7.2.4. Laboratory structure: a concrete framework 128
2.8. Towards a design methodology 138

PART 3
DESIGN AND TECHNICAL SYNTHESIS (pg. 142)

3.1. The formative design 144
3.2. Diverging from the process 148
3.3. Reinterpreting the original ideas 150
3.4. Design development on a micro-scale 152
3.5. Culmination of the design development 156
3.6. Incorporation of the technical implications 168
3.7. Development of the technical design 172
3.8. Revealing the invisible: Towards a design proposal 178
3.9. Technical resolution: Documentation APPENDIX

PART 4
REFLECTION AND EVALUATION (pg. 190)

Bibliography 194

INTRODUCTION

Development of a personal interest: **the inequality of disease**

The average human life expectancy has doubled from about 30 years in 1900 to 63 in 2000 (World Health Organisation, 2014: online). Technological developments, especially those in medical fields, have succeeded in raising the life expectancy of the global human population. Nonetheless, the kind of progress that has reached for paradigm-shifts and succeeded in saving lives is not readily available to all. In developing countries, such as South Africa, 42 percent of deaths are caused by infectious diseases, compared to an average of 1.2 percent in industrial, developed countries (Medical Research Council, 2010: 1).

The human immune system is inherently designed to protect a person from dying when a harmful pathogen infects the body. However, the effectiveness of the human immune system is largely a function of diet, which is in turn mostly dependent on income level. Furthermore, even though medical technology has made great leaps in its abilities to cure and prevent disease, these methods, be they pharmaceutical or educational, are not readily available to certain marginalised societies and groups of people that exist in economically vulnerable areas. Essentially, even though dramatic progress has been made in understanding, curing and, more importantly, preventing the spread of infectious diseases over the last century, the aim of making this progress equally available has regressed.


1


2

Disease and SPATIAL SEGREGATION

Diseases, especially those of an infectious nature, being transmittable between human beings, feed a primitive psychological fear of "otherness", and ideas associated with disease exacerbate antagonism towards "the other" (Lambert, 2014: online). This fear grows out of a fixation on contamination between bodies in an essentially invisible realm; fed by factors of the unknown and unseen. With the 2014 outbreak of the deadly Ebola virus in west Africa, we were able to observe the way in which economically developing countries can be devastated by disease and how, in the case of West Point, Liberia, distinctions related to disease and those affected by it play into aspects of spatial segregation. This aspect of fear and spatial segregation is carried through to a global level, and directly affected the entire African continent – tourists were hesitant to visit South Africa, for instance, even though the outbreak had occurred in north Africa.

When an epidemic occurs as radically and unpredictably as Ebola did, societies fall to a system of urban crisis organisation, whereby a meticulous administration of territory dominates public thought (Lambert, 2014: online). There are instances where entire villages and urban-sectors were quarantined – as happened in West Point – essentially sacrificed to save the general population. These are areas that are distinguished by their low ranking in an economically perceived social order, and when paired with the stigma and antagonism caused by disease, the result is the radical emergence of segregation and additional inequality. According to Lambert (2014: online), compromising a certain group of people in the context of an outbreak of disease operates to the same logic as the more usual strategies of societal exclusion constructed around group-based and racial segregation, and can therefore be likened to allegories of oppression.

Additionally, segregation is experienced within these segregated groups themselves. Because the prevention of the spread of disease is dependent on the understanding, awareness and public-knowledge thereof, where adequate education about disease is not provided, usually in economically vulnerable areas, those affected by disease often experience severe cultural stigmatisation within their own communities, resulting in exclusion and isolation. Therefore, within this context of understanding, this project is proposed to engender awareness through education and, in doing so, to provide a platform for research that is engrained in a broader public interest.

IMAGES:
1. West Point residents look out of the locked gate on the second day of the Liberian government's Ebola quarantine on their neighbourhood.
2. A slum resident looks through the bars of the closed gates of the quarantine area.
3. A Doctors Without Borders (MSF) member wearing protective clothing stands in the high risk area of the Ebola treatment centre.

(All: John Moore/Getty Images - http://www.ibtimes.co.uk/ebola-liberia).

DOCUMENT FRAMEWORK

The investigation of this dissertation focuses on the needs and requirements of a microbial laboratory to conduct scientific research and data analysis. A major component of the project investigation was aimed at exploring "humanising the scientific institute" and seeking a means for creating a building type that is more conducive to the people who work inside it and those who are required to interact with it. The investigation was justified through the exploration of similar building types and their effects on the user (precedent and case studies); how such an institute would work on the proposed site through a process of analysis; how the site could be repurposed to suit the client's requirements and needs of the community better; and how a theoretical application can be made towards finding a unique approach to the design of such scientific institutes and laboratory workspaces.

The first half of this dissertation, Parts 1 and 2, is structured around four terms as understood from an academic architectural understanding, namely typology, topology, morphology and tectonics. In this document the study of typology refers to an exploration of associated building types according to the more functional requirements of the proposed project; while topology refers to the investigation with regard to the facts and qualities identified on the site and within the broader context, which influence an understanding of place. Morphology, which broadly refers to the form-giving qualities, is understood as the conceptual constructs that can guide a unique approach to the implications of the typological and topological investigations, and which can contribute to a sense of meaning and successful "place-making"; while the term tectonics refers the "art" of construction – using structural systems and approaches to not only successfully construct the project in terms of its physical implications, but also to consider how the tectonics can reinforce the conceptual ideas expressed in the morphological component.

The third part of this dissertation comprises a synthesis of all the considerations made for the design and consequential structure. This part will see the realisation of a building, and explain both the development of the design and tectonics. Lastly, in the fourth part, the dissertation will come to a conclusion about the success of the synthesis in achieving the initial aims set out at the inception of the investigative process, by means of reflection and evaluation of the overall development.

RESEARCH DESIGNS AND METHODOLOGY

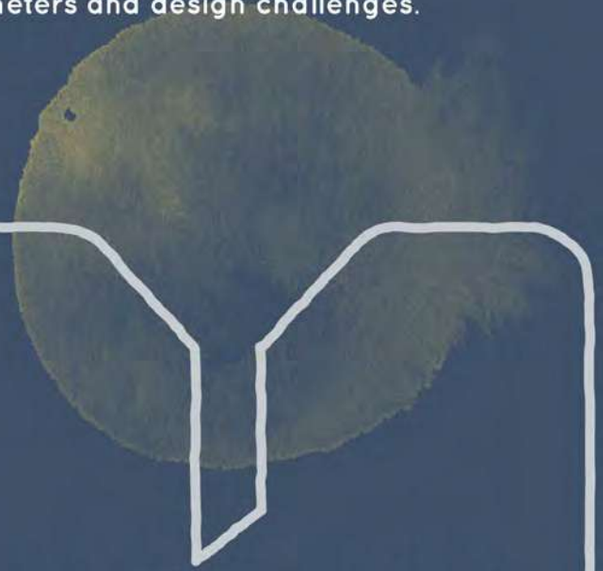
For the purpose of this dissertation, which was focused around a method of explorative research, investigations were based on the fundamentals of the primary problem statements aimed at achieving the product of a final design. The investigations sought to explore what to design for whom (the client and brief); the best location for this design; how the morphology and form-giving factors of the design were influenced; and also how the design was constructed in terms of the relationship between structural elements (the tectonics). These elements of the investigation were related to specific sources of knowledge that would influence the logic of these four factors. The research originated from an interest in the subject of disease control in South Africa, predominantly through investigating the client and type of facility required, and from this interest different sources of knowledge were explored in an attempt to develop a design methodology specific to the requirements of this project.

The sources of **explorative research** which were employed include the following methods:

- A "touchstone", which identified the intuitive essence of the intentions of the project, was created, from which certain concepts were developed, and which in turn generated a conceptual framework.
- This conceptual framework was used as an analytical tool to make conceptual distinctions and organise ideas.
- These initial ideas were explored in precedent and case studies, and sought to be grounded in theory.
- Architectural precedent analysis (built examples) and case studies, which brought together a literature review with regard to the projects; a personal analysis; a cognitive analysis explaining how the case study was experienced on a personal level; and an interpretive analysis.
- Literature (theoretical) was interpreted and analysed, both critically and creatively (by means of reflection).
- An interview was conducted with post-graduate students with regard to the case study.
- A site investigation dealing with both quantitative information (existing and interpreted facts and measurements) was conducted; as was a qualitative/cognitive analysis, which focused on the personal phenomenological experience of the site and context.

1 problem statements

Orientation: an introduction to the project; defining the problem statements through an understanding of the project **parameters and design challenges**.



What will be investigated with regard to:
Typology, topology, morphology and structure.

An explanation of the initial **investigative process**, demonstrating discourse in terms of knowledge, comprehension, application and analysis.

components of research 2

- Investigation of the building typology.
- An analysis of the proposed site.
- Forming the conceptual framework.
- Exploring structural implications.

A portrayal of the design process that intends to convey the **different phases of development** with the aim of moving towards a final design proposal.

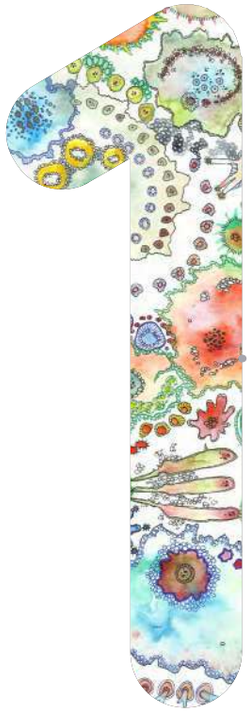
3 design & technical synthesis

Utilising the knowledge gained during the investigative process to formulate a specific approach to the design.

A personal understanding of the process of analysis, exploration and grounding, and design approach.

evaluation & reflection 4

Looking back at the project in hindsight and identifying the challenges that were incurred due to certain decisions while reflecting on the process of design.



1.1 TYPOLOGY

1.1.1. CLIENT AND USERS
1.1.2. INITIAL BRIEF
1.1.3. PROBLEM STATEMENT
1.1.4. AIMS

1.2 TOPOLOGY

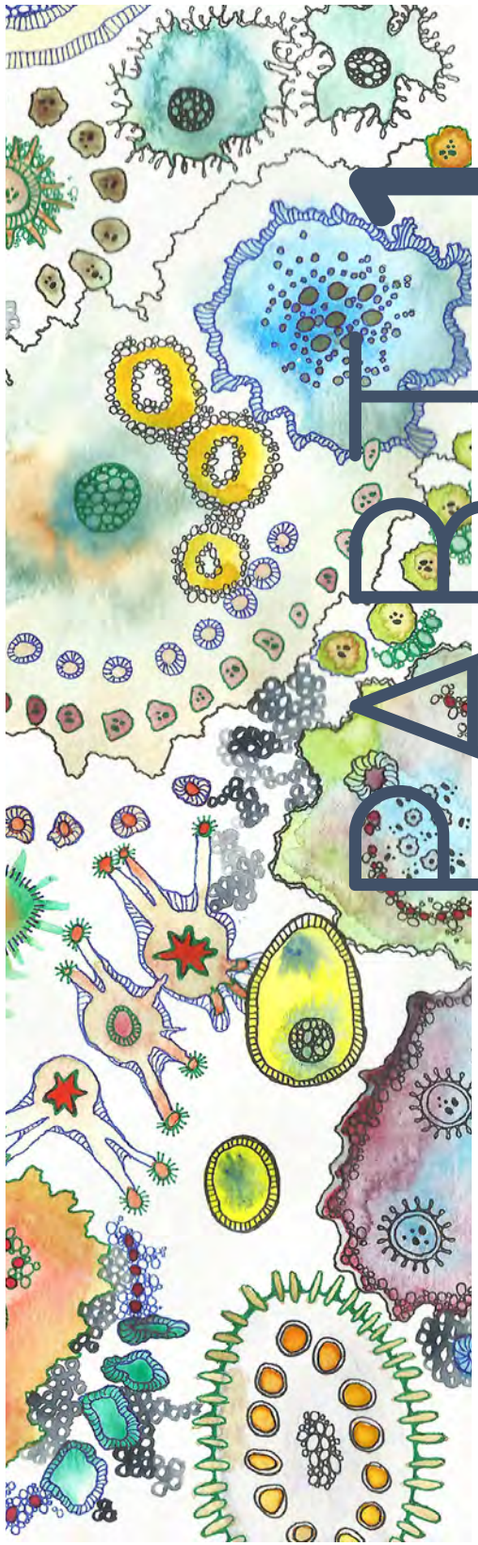
1.2.1. PROBLEM STATEMENT
1.2.2. AIMS

1.3 MORPHOLOGY

1.3.1. PROBLEM STATEMENT
1.3.2. AIMS

1.4 TECTONICS

1.4.1. PROBLEM STATEMENT
1.4.2. AIMS



PART 1

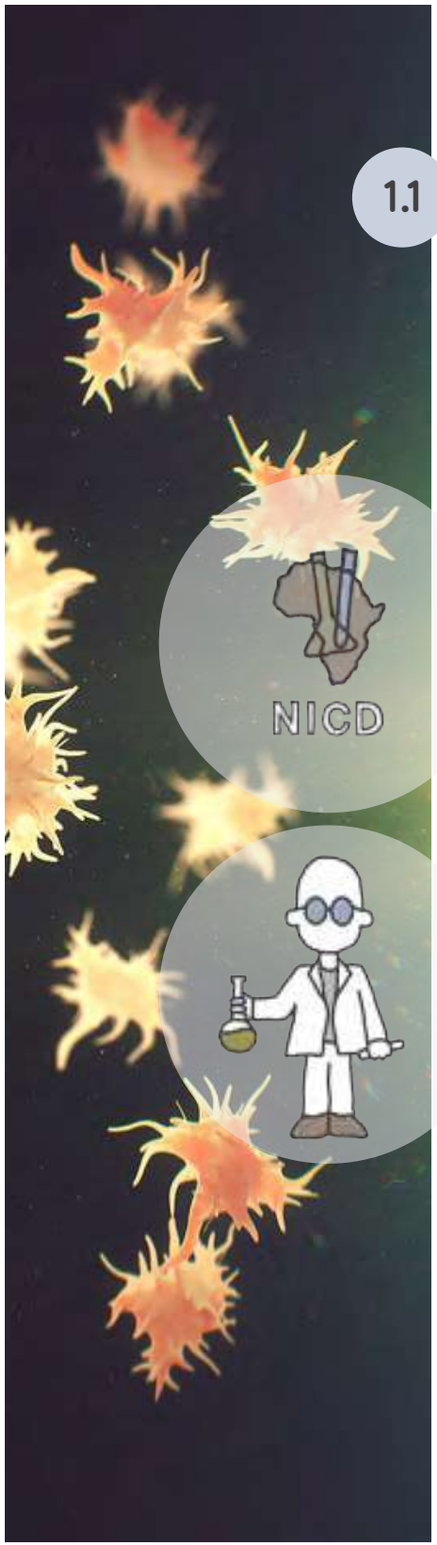
PROBLEM STATEMENTS AND AIMS

The process of defining the challenges and problems that are presented was initiated by an investigation into the typology of the scientific institute, and a microbiology laboratory specifically. The first interest with regard to this dissertation was the notion of establishing an institute dedicated to the control of communicable diseases in the context of Bloemfontein, and how such an institute can commit part of its primary intentions to fostering public interest and a broader willingness to learn. The client played a role in initiating this train of thought, and it was upon investigating who the true user of this building would be that the consequential challenges and parameters could be identified.

The selection of a site suitable for the proposed building typology and the project's initial intentions was an aspect that required a fair amount of consideration. The site that was ultimately selected presented challenges in terms of both design and defining parameters. Decisions had to be made with regard to the nature of the site, its size, and the existing structures found on it; these decisions had to adhere to the language of the context without detracting from the requirements of the building type.

Whilst identifying the challenges related to typology and topology, an investigation into morphology and certain principles of form-giving, so to speak, was perceived as a way of developing a unique approach to conventional laboratory design. The normative approaches to designing laboratories resist some of the particular intentions of the proposed project, and were therefore identified as challenges with regard to morphology. The tectonic approach to this project, pertaining to the use of certain structural systems and their specific relation to conceptual notions, was seen as a means of reinforcing morphological ideas and constructs. Therefore, the process of defining the problem statements with regard to tectonics was closely related to identifying the challenges of morphology.

It is important to note that this process of exploration and investigation was by no means linear. Moving back and forth between the consideration and implications of typology, topology, morphology, and tectonics became an integral feature of the process of forming the decisions that would ultimately shape the project.



1.1 TYPOLOGY

The typology of this project can be classified as that of a scientific institute, and with that classification come certain connotations attached to the archetype. The building typology and specific subject matter that it would deal with determined the choice of client, who in turn became essential in determining the brief of the project. The client represented a body with a specific mission statement that reinforced the goals of the project.

CLIENT

The National Institute of Communicable Disease (NICD) operates out of Johannesburg, and is in need of an additional centre to assist with the laboratory services they render to the rest of South Africa. This institute will be tasked with microbiology research into the nature of disease amongst people, with a large emphasis on studying the role of effective nutrition in minimising the consequences of communicable diseases. Regarding its contribution to raising public awareness, the NICD has taken on ventures to assist in public education and reversing the stigmatisation caused by infectious diseases in South Africa.

USERS

The proposed project will seek to provide a platform for research into disease control, as well as the opportunity for educational activities on a broader, more public basis. The intent is that the building and its facilities can be utilised by professionals in biomedical fields, postgraduate tertiary education students seeking careers in one or more of these fields, as well as members of the general public who are interested in expanding their knowledge of infectious disease. When a facet of human existence, especially one as important and influential as communicable disease, can be better understood – better related to – the inherent fear thereof is minimised and we begin to find ways in which to deal with this aspect of our lives.

IMAGE (LEFT): "Microorganisms", Alexey Kashpersky, 2014. *(Source: Artist's official website - http://www.kashpersky.com/ - 1 August 2015).*

INITIAL BRIEF

By request of the client, the initial brief calls for the design of a centre comprising facilities suitable for scientific research and data analysis of a microbial nature (i.e. laboratories and all necessary associated services); facilities dedicated to the work of both scientific and administrative staff and that encourages interdisciplinary interaction; and also the development of an architectural intervention that will generate public awareness with regard to disease control and foster an interest in the associated fields of research without detracting from the sensitive nature of the research. Because this centre will be conducting specialised research on the role of effective nutrition in combating communicable disease, there was also a request for some kind of fresh-produce garden as part of a community initiative.

1.1.1. PROBLEM STATEMENT

The nature of work conducted by research laboratories, particularly those concerned with infectious disease, is of a serious nature and requires conditions that meet stringent standards of hygiene, safety, security and privacy. These conditions do not necessarily seek to accommodate human beings and make them comfortable as design aspects are given over to programmatic requirements, much like in a hospital; even though the essential and sensitive work conducted within such spaces would not be possible without the endeavours of people. Furthermore, the secrecy with regard to this line of work only adds to public stigma regarding such structures, and alienates the general public from something which affects them on a daily basis. This stigma builds on the fear of "the other" and delineates the laboratory as a strange, unfamiliar place where classified experiments take place.

1.1.2. AIMS

The primary aim would be to present a functional design and organisation of the client's needs while asking the question: how can the typical approach to laboratory design surpass traditional ideas of "form follows function", to create a spatial experience that goes beyond the pragmatic while still meeting the needs of a scientific institute? The laboratory needs to made less austere and frightening; the veil of secrecy needs to be removed to the extent that the public may be intrigued by the work of scientists, without detracting from the work that scientists conduct.

1.2 TOPOLOGY

The proposed site is on the corner of two important arterial roads in Bloemfontein, located within what is currently the Free State Psychiatric Complex in the suburb of Oranjesig, on the periphery of the golf-course managed by the Free State Department of Sports and Recreation.

1.2.1. PROBLEM STATEMENT

Although the physical topography of the site itself, being relatively flat and even, does not present direct challenges to the design of the proposed project, the context of the built environment offers a challenge, namely, to consolidate different architectural languages. In other words, the proposed site is directly influenced by varying architectural styles that allude to different zeitgeists that occurred over time within the South African context. Additionally, the site is in direct contact with an increasingly disused golf course; posing questions of necessity, sustainability, and presenting the opportunity to investigate the repurposing of supposed wasted space.

1.2.2. AIMS

The primary aim would be to ensure responsible engagement with the complexity of the context in all spheres of the human-ecological environment, namely, the natural, man-made, historical and socio-cultural. The nature of the specific built environment, comprised of architectural languages dissimilar to and unfamiliar with one another, should be consolidated through the proposed architectural intervention. Because the project is situated on a corner site, it has a certain role in facilitating a form of public interaction and mediating transitional spaces. Furthermore, the nearby golf course, as a precursor to future requirements within urban areas, can be repurposed and made to suit people's health needs better. This golf course needs to become a place that engenders community interaction, thereby stimulating an aspect of disease awareness brought forth by the institute.

IMAGE (LEFT): Aerial view of the proposed site within Bloemfontein. *(Source: Google Maps - https://www.google.co.za/maps/place/Oranjesig,+Bloemfontein,+9301/@-29.1322899,26.2165679,15 - 14 February 2015).*

1.3 MORPHOLOGY

1.3.1. PROBLEM STATEMENT

Conventional approaches to form-giving when it comes to the design of functional laboratories are largely determined by the structural systems most suitable to achieving pragmatic considerations. In other words, form-giving qualities of laboratory design are granted to function over human-experiential and sensory needs, even though the human being, namely, the scientist, is the primary means by which these facilities function. This approach towards design often excludes an architectural expression of the nature of the work conducted in the scientific institute, only adding to the stigma of secrecy associated with these institutions and exacerbating fear within the public domain.

1.3.2. AIMS

The primary aim would be meaningful place-making by investigating certain concepts and conducting a review of different literature and methods of analyses. Contemporary architectural theories need to be incorporated with an idea of scientific practice to initiate places of innovation and social interaction, and leaning away from previous tendencies to generate spaces of estrangement. An understanding of certain architectural philosophies must be combined with the needs of a microbiology laboratory to create an institute that shifts away from conventional notions associated with an “institution”. The project seeks to find the role of architecture in revealing aspects of the unknown, namely disease investigation and research, to the public realm, without creating an air of alienation or initiating a sense of fear of the unfamiliar. Additionally, the unique and specialised knowledge of the scientist must be celebrated through an approach to the design methodology that is expressed in the architecture.

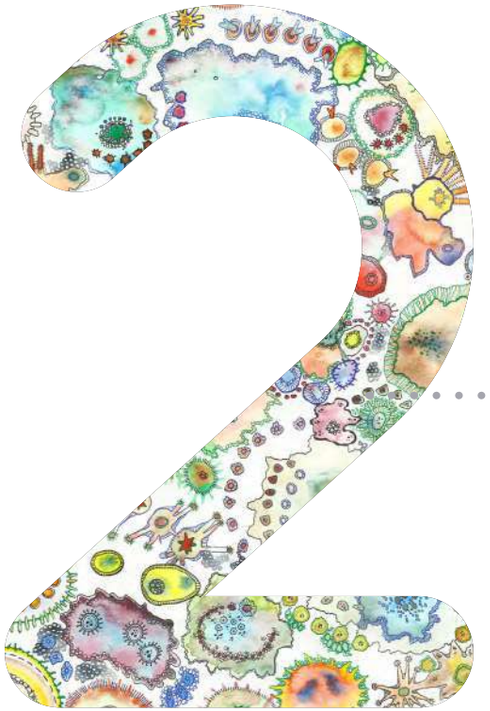
1.4 TECTONICS

1.4.1. PROBLEM STATEMENT

The conventional structural approach to laboratory design is closely tied to the morphological implications expressed above, in that construction decisions contribute significantly to the secrecy associated with these institutions. When designing laboratories, especially those meant for the purpose of microbial research, ancillary services and the inclusion of speciality equipment must be determined as early as possible, so that they can be incorporated in the structural system. It is these considerations that ultimately determine the safety and security of such a facility. Because the functional programme is so important, the chosen structural system will, for the most part, be considered conventionally for this programme, with far less importance placed on tectonic expression. Therefore, it becomes difficult to express the conceptual framework in the architecture, which is so dependent on the structural approach.

1.4.2. AIMS

The tectonic expressions need to communicate the results of the investigation conducted to ground a unique approach and new design methodology. In other words, structural considerations and detailing must conceptually express the lessons, so to speak, that have been learnt from the exploration and grounding of the project's research. At the same time, the project must still pertain to the structural requirements of a laboratory so that it remains a functional, workable space that is able to fulfil its specific purpose. Therefore, the ultimate aim in terms of tectonics is to find a means of synthesising the conceptual approach with the pragmatic necessities. Through a process of investigation into the special services necessitated by laboratory buildings of this type, and the structural approaches that are best suited to these services, the project aims to achieve the required standards of usability, while allowing for a tectonic articulation that permits the detailing to become expressive of the broader conceptual framework.



2.1 TOUCHSTONE

2.2 FORMATIVE CONCEPTUAL IDEAS

2.3 CONCEPTUAL FRAMEWORK: A GLOSSARY

2.4 TYPOLOGY

2.4.1. INVESTIGATING THE CLIENT AND USER
2.4.2. EXPLORING SIMILAR BUILDING-TYPES (PRECEDENTS)
2.4.3. ACCOMMODATION AND USER LIST

2.5 TOPOLOGY

2.5.1. HISTORY OF THE CONTEXT
2.5.2. THE CORNER PREDICAMENT
2.5.3. WASTED SPACE
2.5.4. QUANTITATIVE SITE ANALYSIS
2.5.5. COGNITIVE/QUALITATIVE SITE ANALYSIS

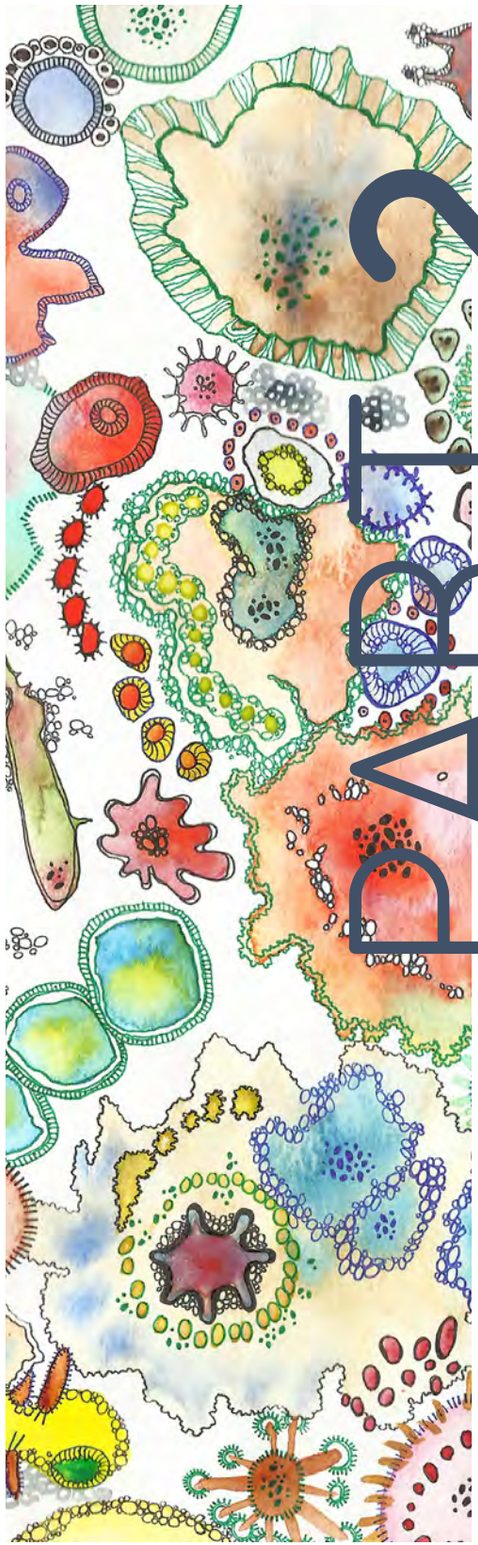
2.6 MORPHOLOGY

2.6.1. IDENTIFYING A UNIQUE APPROACH
2.6.2. MORPHOLOGICAL PRECEDENT
2.6.3. DISCOURSE: GROUNDING A UNIQUE APPROACH THROUGH THEORETICAL EXPLORATION

2.7 TECTONICS

2.7.1. STRUCTURAL CONCEPT EXPLORATION
2.7.2. TECHNICAL REPORT

2.8 TOWARDS A DESIGN METHODOLOGY



PART 2

EXPLORATION AND GROUNDING

In order to develop a certain approach to the problems and design challenges that were identified, a touchstone was created as a means of highlighting the essence of what the proposed project intends to convey. From this "benchmark", and in conjunction with the initial conceptual ideas developed from it, the process of initiating research started with an investigation into the typology of a microbiology research facility. This investigation was aimed at understanding the inner-workings of a laboratory and the way the building itself, the environment of the laboratory, affects the people working inside it.

Precedent studies and a case study were used as the primary means of exploring the building typology of this kind of scientific institute. The investigation then moved to exploring the proposed site and its suitability for the project. The site was analysed from both a quantitative perspective, which focused on interpreting data and information of a more factual nature, as well as from a cognitive point of view, which involved a personal, experiential analysis of the site and context. It was important to analyse the site in terms of the undiscovered opportunities it presented, which could be used as a means of reinforcing a unique morphological approach.

After conducting the site analysis, and in conjunction with a continual consideration of the selected precedents, the morphological approach to the design of laboratories was explored as a means of theoretically grounding a unique methodology that can begin to consolidate conventional, pragmatic considerations with the requirement of developing a new understanding and public interface. In other words, the process of research became focused on finding a means of bringing a new facet to mainstream laboratory design that would meet the specific requirements of the brief.

The tectonics of laboratory design cannot be separated from the functional requirements or morphological implications thereof; they are interdependent aspects of generating a building of this type. Therefore, exploring a structural approach became an important part of the overall design process and a means of investigating a way to tie the typological, topological and morphological explorations together.

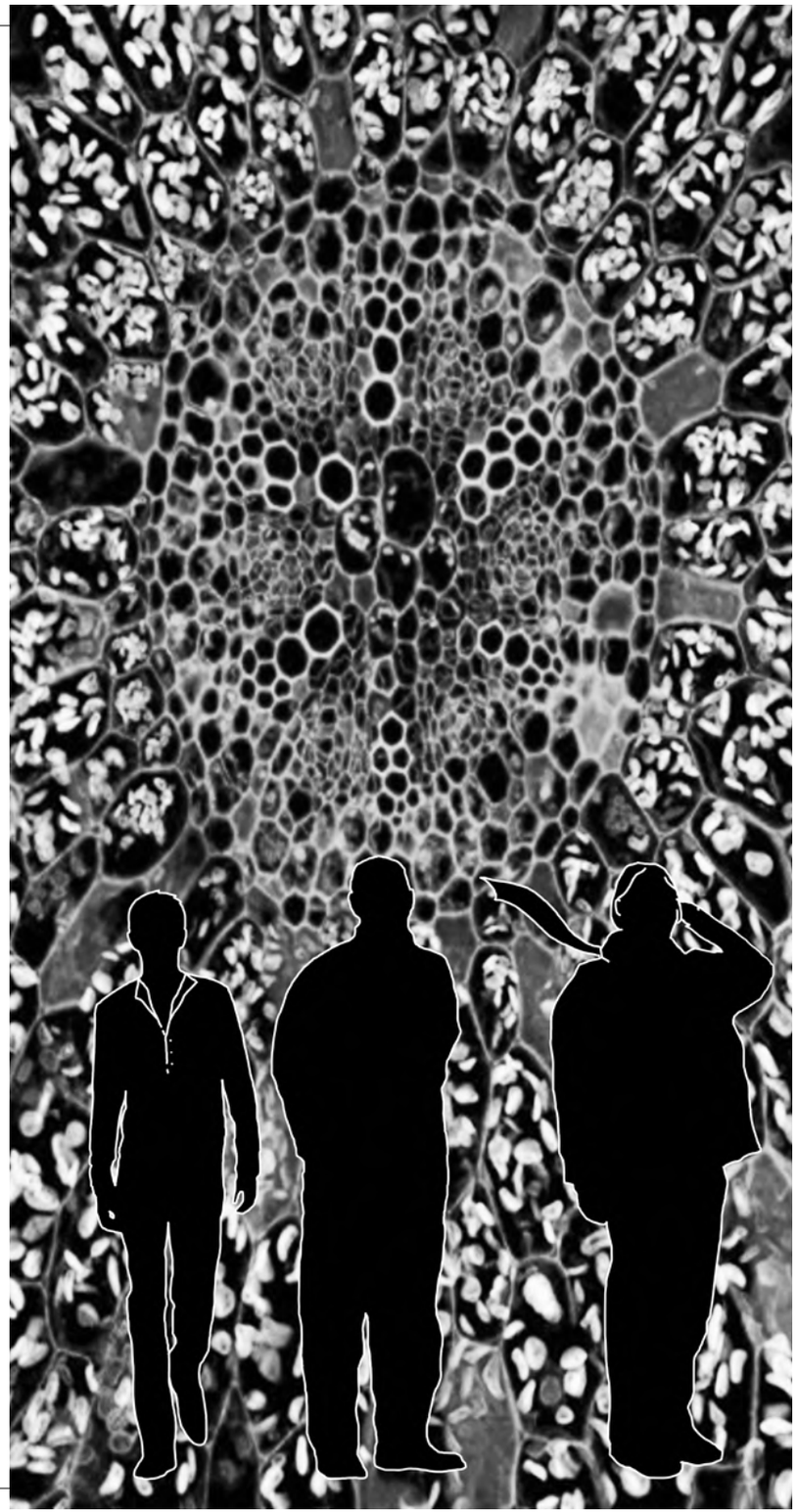
2.1 CONCEPTUAL DEVELOPMENT: *TOUCHSTONE*

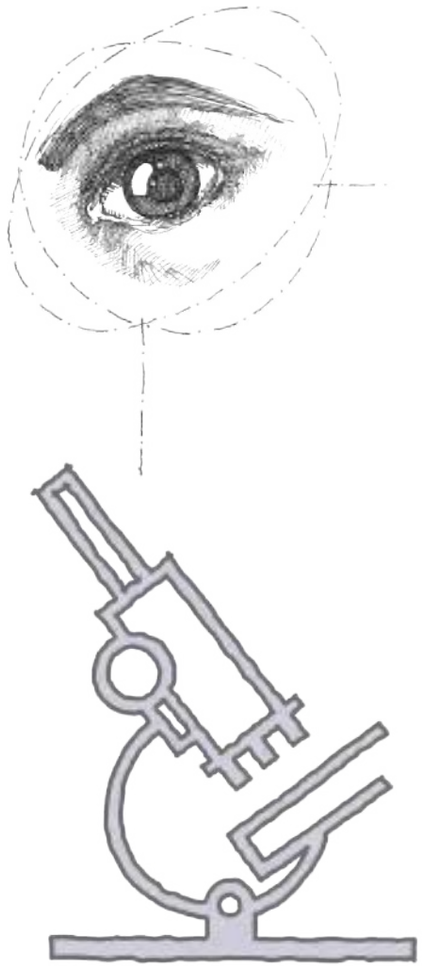
By definition, a touchstone refers to a black siliceous stone, related to flint, which can be used to test the purity of gold and silver by the streak left on the stone when rubbed by the metal in question. It is also defined as a test or criterion for determining the quality or authenticity of a thing; a fundamental or quintessential part or feature (Merriam-Webster dictionary, 2015). For the purpose of this investigation, the creation of the touchstone refers to that which is generated to determine the essence of the intent of the proposed project.

Ultimately, the essence of this institute would be to create awareness and its aim would be to prevent the spread of disease by means of education. Education and awareness can be used to combat fear, ignorance and stigma. But how does one create awareness about a microscopic world that is far beyond a human being's perspective of understanding? How does one go beyond the limitations of our vision?

The microscopic world is invisible to the naked eye. Before the invention of the microscope it would have been easy to deny the existence of this microscopic realm entirely. Therefore, the microscope can be perceived as a tool that unites us with this seemingly invisible realm. What we deem as observable is restricted to the way our eyes are able to discern light, and the microscope (as well as further developments thereof) are therefore tools that overcome the physical limitations of our vision. In other words, it is a tool that creates a means for understanding the relationship between two seemingly unrelated worlds. It has allowed us to begin to understand this "unknown realm" that exists right beside us, on top of us, inside of us, and all around us – a world of microorganisms that far surpasses our own in terms of magnitude; a world of radically different perspectives.

The microscopic world of disease, germs and bacteria speaks a certain language. It is also a realm of ingrained patterns and growing communities – certain diseases evoke certain connotations; bring forth different signs and symptoms and communicate certain facets of their realm to our own. On the proposed site, the language of architecture can be used as a tool to reveal the seemingly invisible and create a sense of relation between apparently unrelated entities.



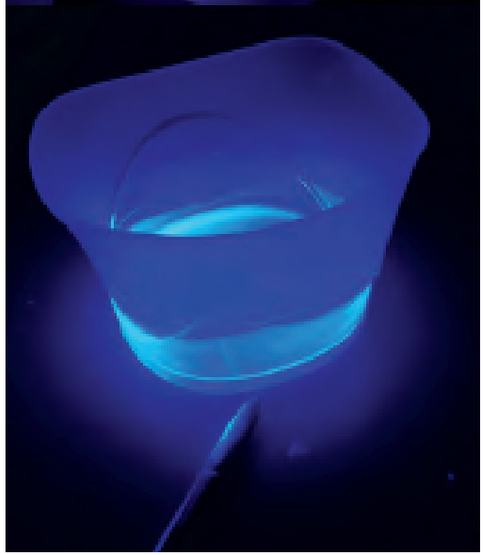


SURPASSING VISUAL LIMITATIONS:
REVEALING THE INVISIBLE

Before the invention of the microscope as we know it today, human beings employed varying methods of magnifying the microscopic world. It was through the study of the way that light is reflected and refracted through transparent and translucent materials of different thicknesses, that human beings could manipulate the way that our eyes discern the world around us. By utilising a tool such as the microscope, we are able to surpass the visual limitations of our eyes as they are and look into the vast and diverse world of microorganisms so that we may better understand it.

IMAGE (LEFT): Visual rendering of the intention of the "touchstone" - a black backdrop covered in a depiction of the microscopic world, far greater and bigger than the human beings.

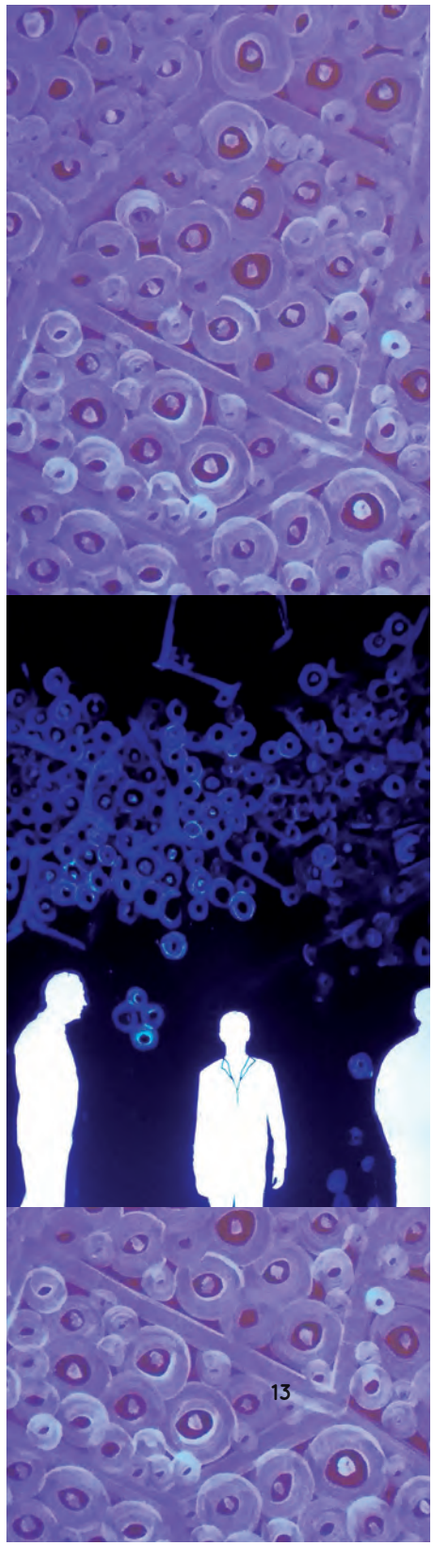
Under “normal” fluorescent light the installation must seem like only a black backdrop showing the silhouettes of the human beings. When the UV light is switched on, the true nature and magnitude of the microscopic world is revealed.



Explaining the touchstone

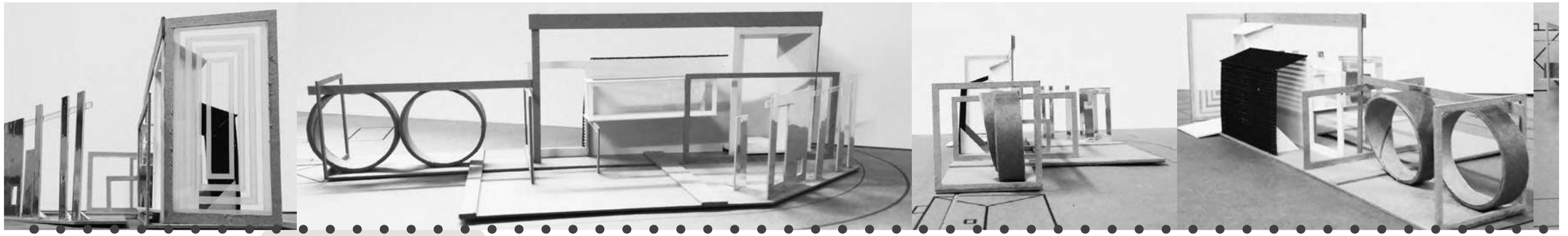
A black sheet, representing the limitations of our human vision, was used as background – the boundaries of the sheet become the boundaries that define what is visible to us. Five white cut-out silhouettes were pinned to the sheet, and patterns were painted onto this background using a liquid laundry detergent, which becomes mostly invisible as it dries. The painted patterns were intended to be symbolic of the magnitude of the microscopic realm, compared to what we as human beings know about it. However, because of the mostly invisible appearance of the detergent, under normal fluorescent light the touchstone would appear as nothing more than the black background and silhouettes.

Phosphors react to ultraviolet (UV) light by glowing. This is why phosphors are added to most laundry detergents – so that clothes washed in these detergents appear brighter in sunlight. Therefore, when a UV light was shone over the sheet, the phosphors in the laundry detergent "paint" reacted and glowed to reveal the painted pattern. In other words, the UV light, as is the case with a microscope and as can happen with an architectural intervention, became a tool by which the seemingly invisible was revealed to the naked eye. The pattern engulfed the sheet and was painted on surfaces beyond the boundaries of the background, indicating that the nature of the realm of microorganism is far greater than we can even imagine.



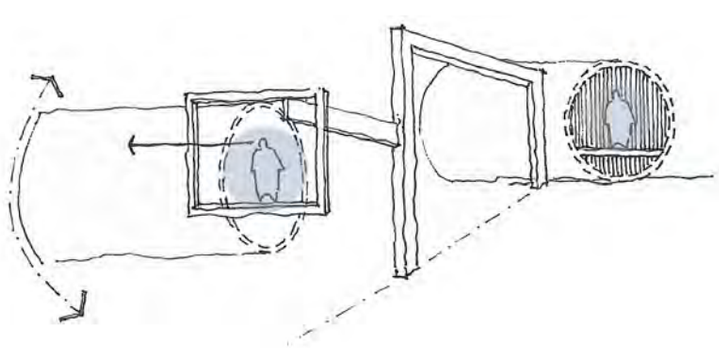
2.2 FORMATIVE CONCEPTUAL IDEAS

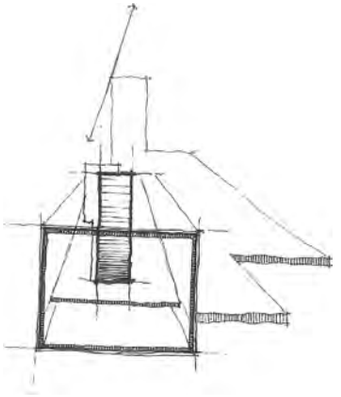
All conceptual models were developed on the site in terms of scale, drawing from the context, and beginning to develop a sense of placement.

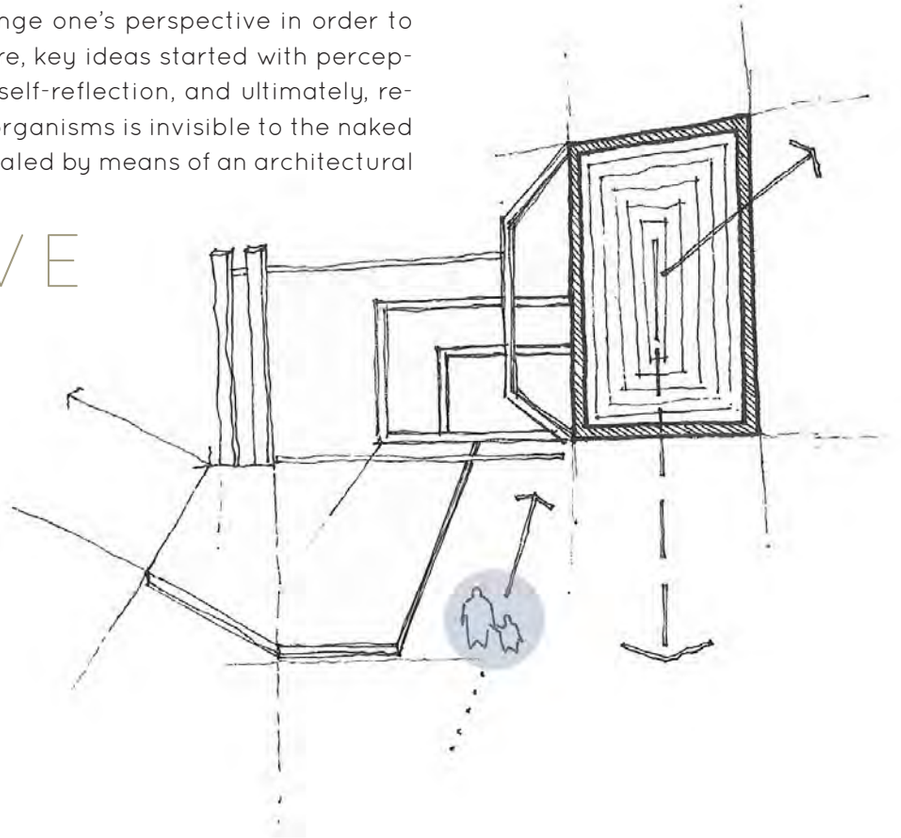


The first concept revolved around how one needs to change one's perspective in order to learn about and understand the world of disease. Therefore, key ideas started with perception, notions of transience, framing views, reflection and self-reflection, and ultimately, revealing hidden aspects. Just as the world of microscopic organisms is invisible to the naked eye, there are features present on the site that can be revealed by means of an architectural intervention.

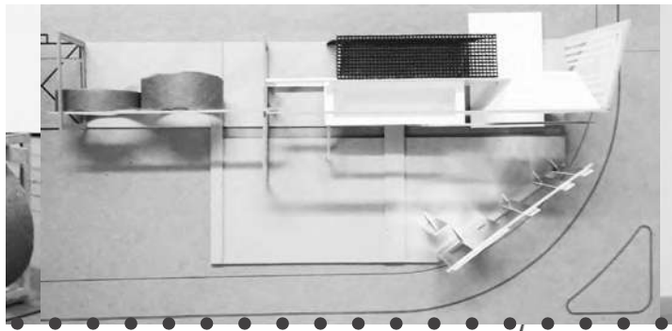
CHANGING PERSPECTIVE

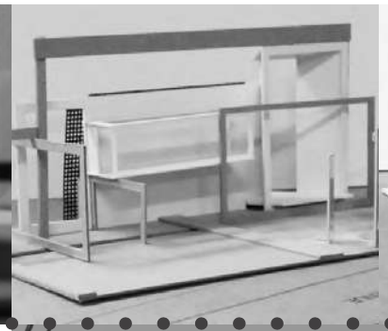


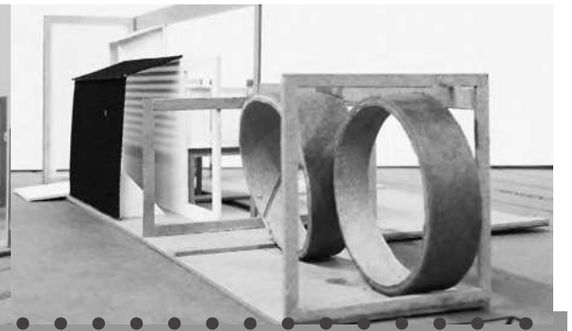


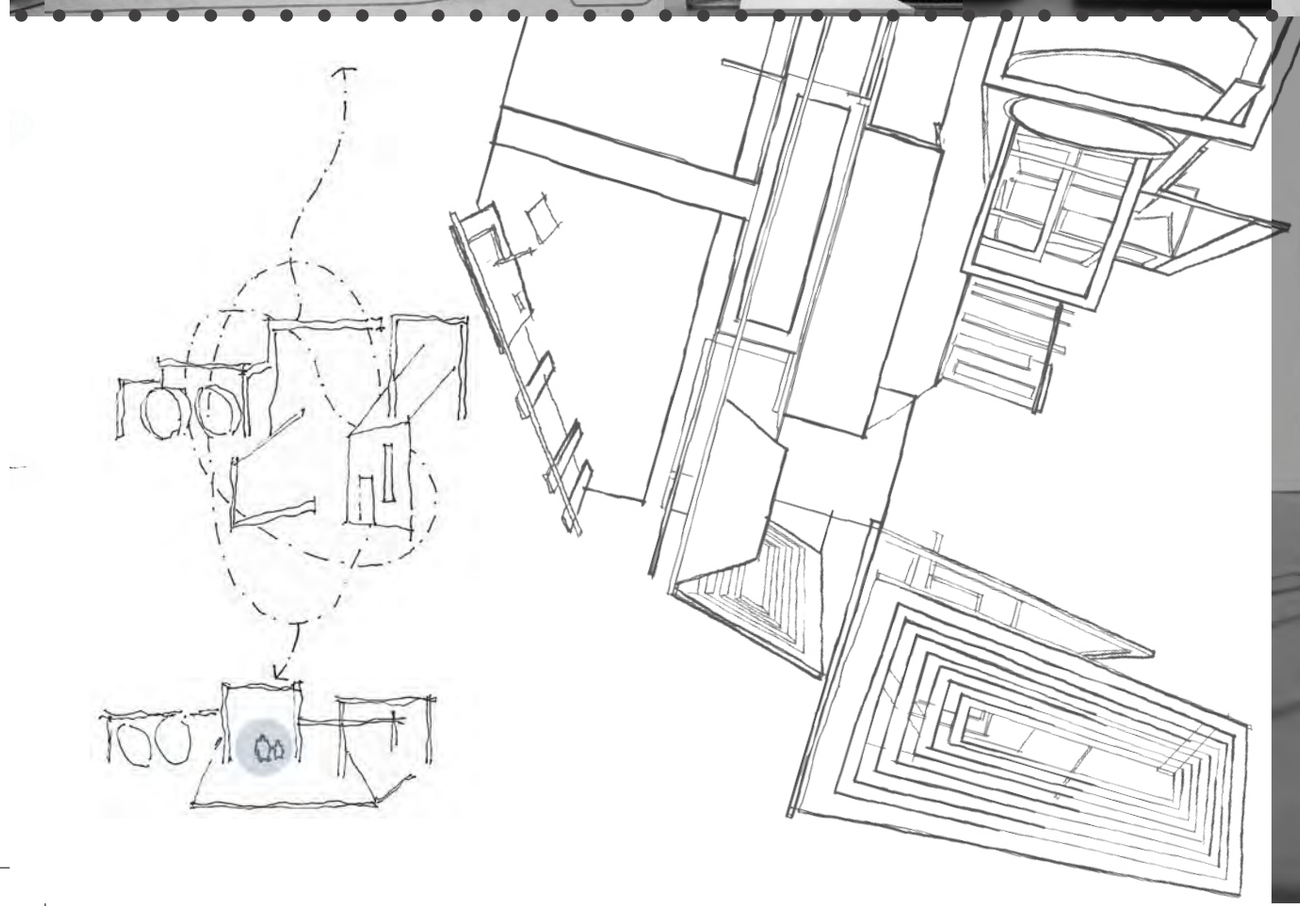


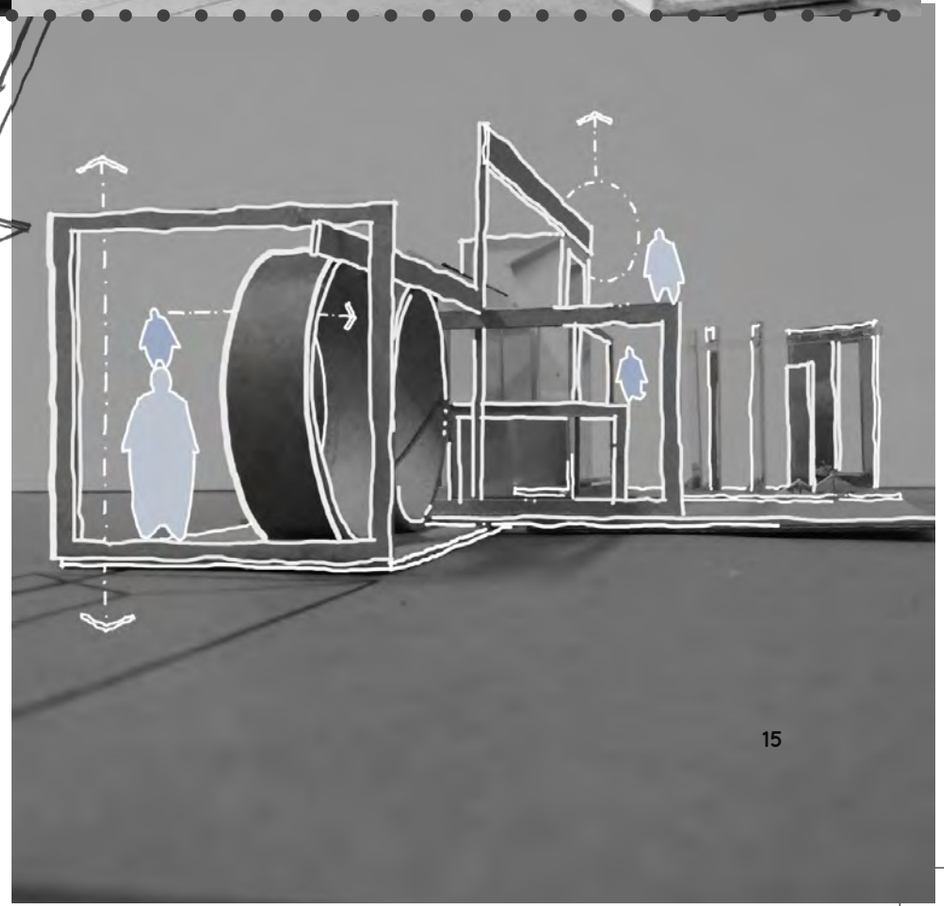
•perception•transcience•frame•reflect•reveal•

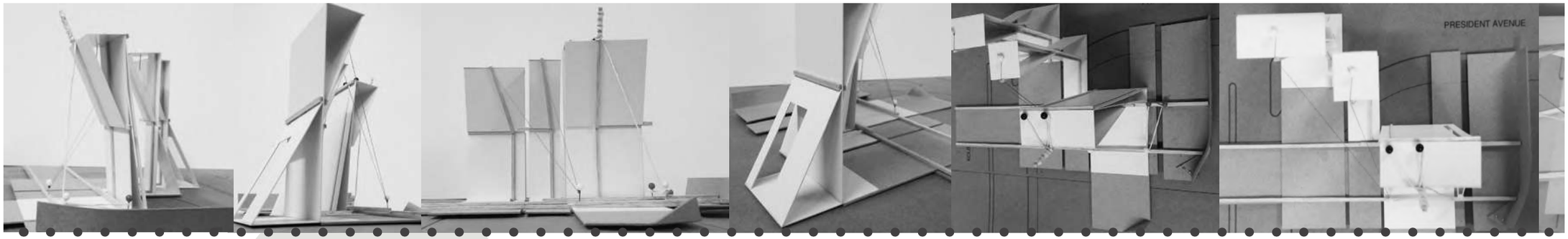








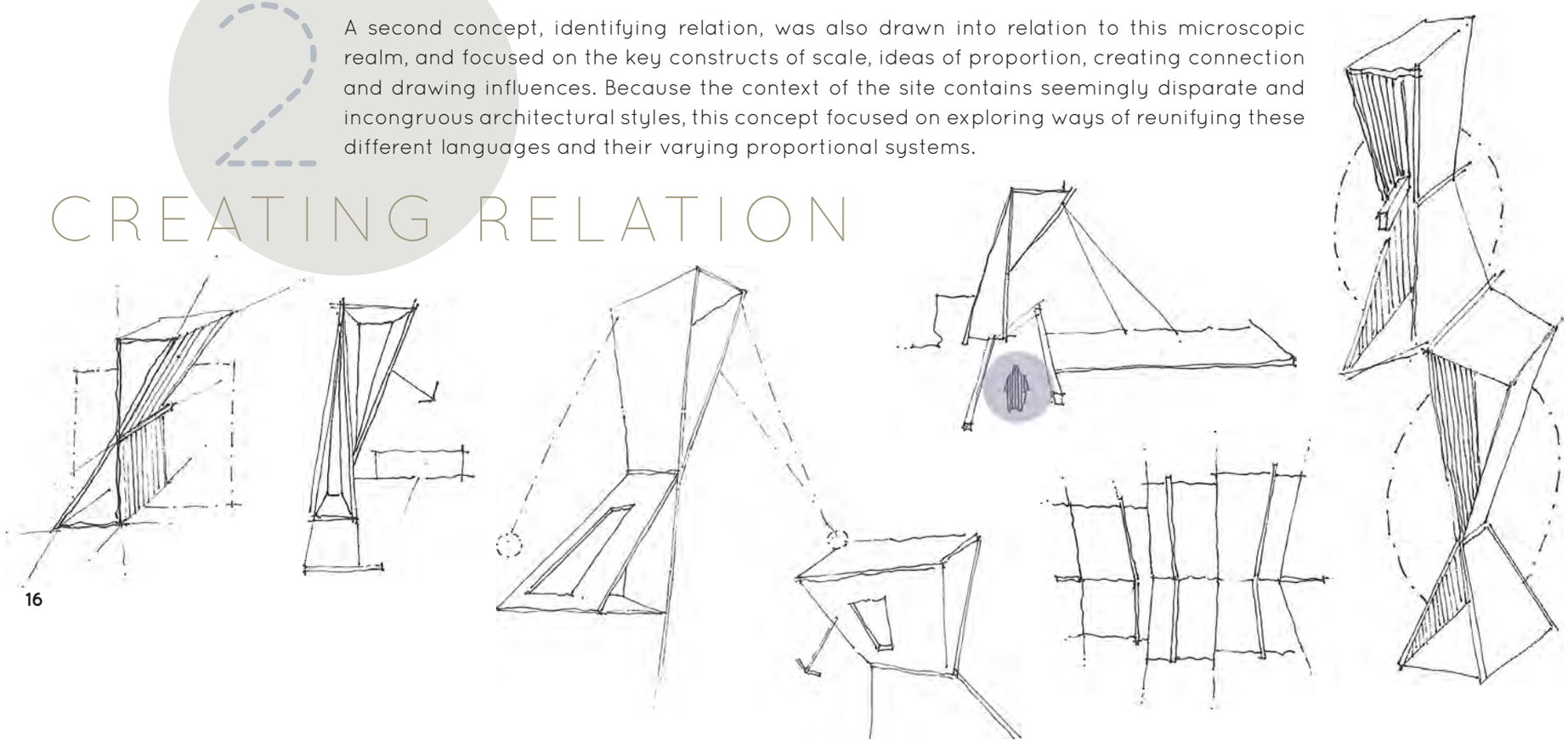




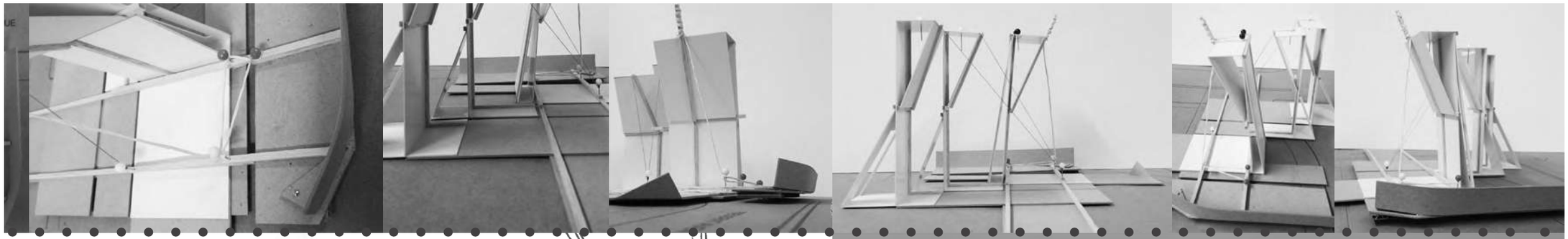
2

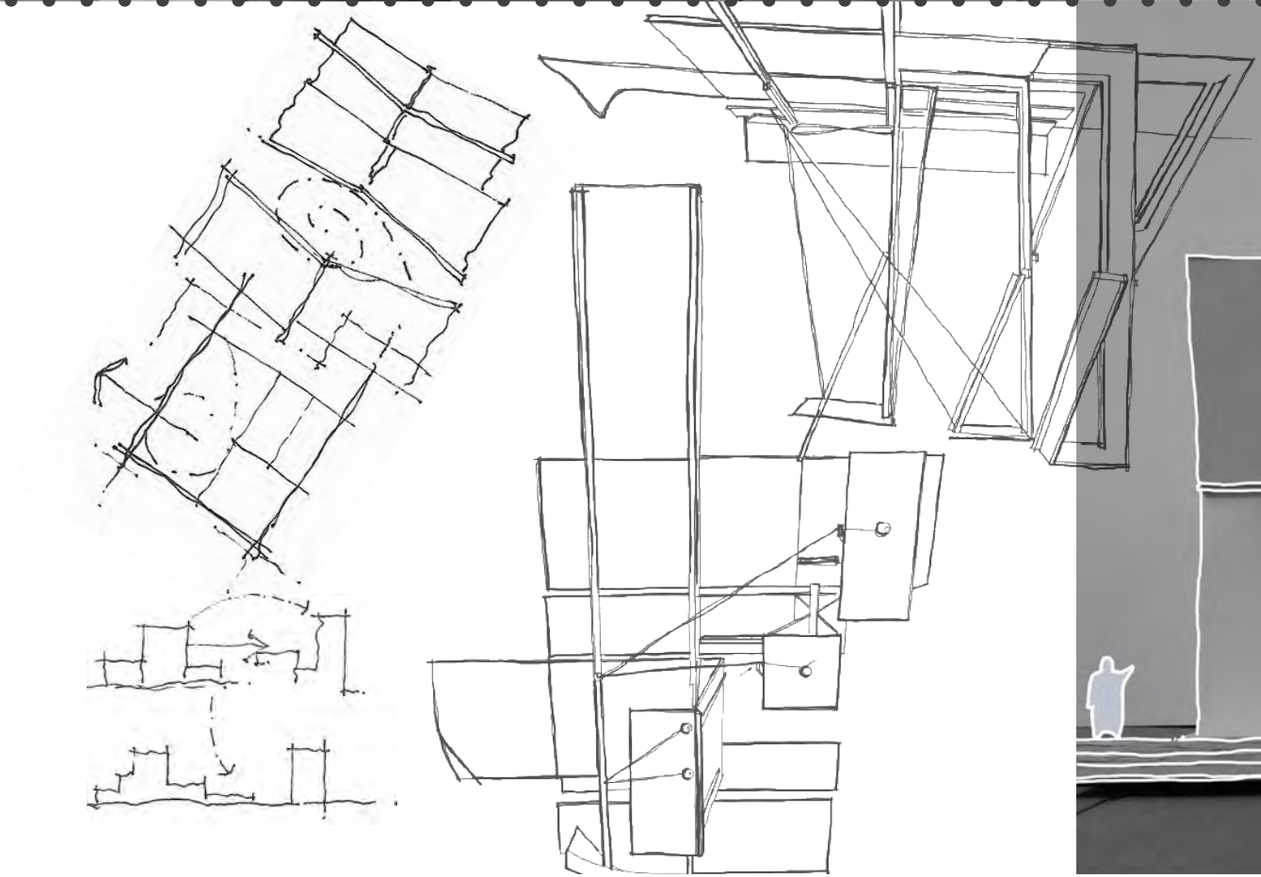
A second concept, identifying relation, was also drawn into relation to this microscopic realm, and focused on the key constructs of scale, ideas of proportion, creating connection and drawing influences. Because the context of the site contains seemingly disparate and incongruous architectural styles, this concept focused on exploring ways of reunifying these different languages and their varying proportional systems.

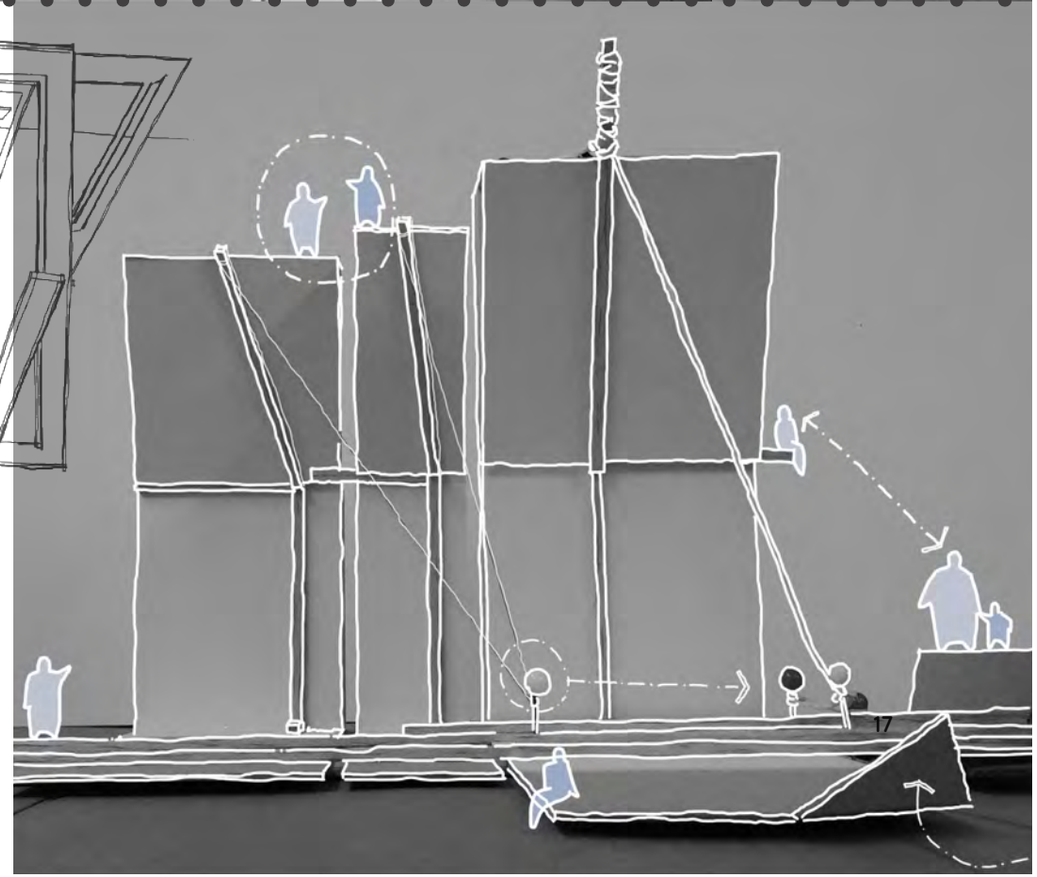
CREATING RELATION

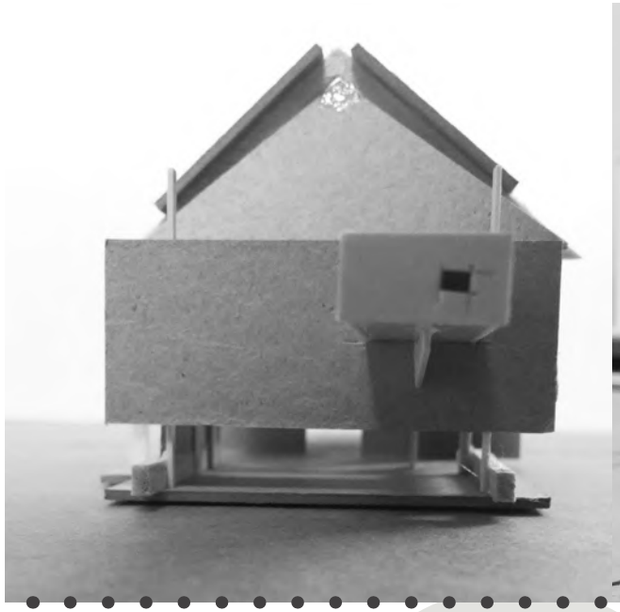


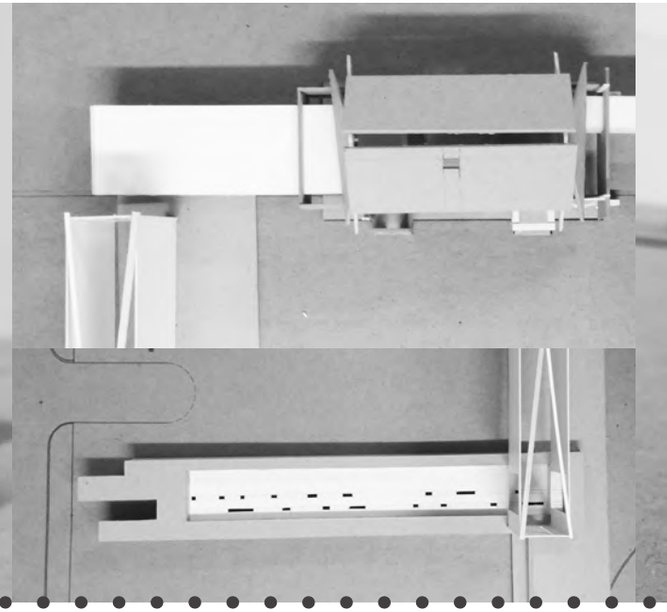
•scales•proportions•connections•influences•







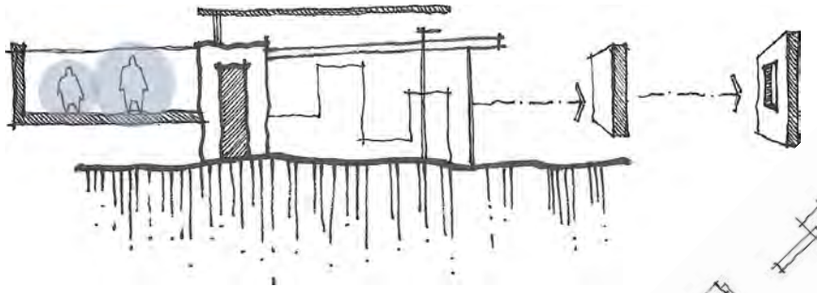


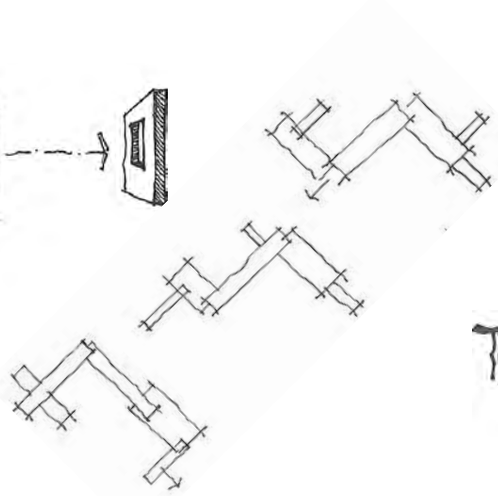


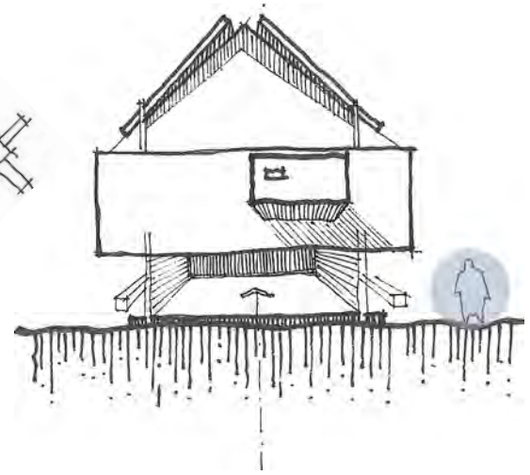
3

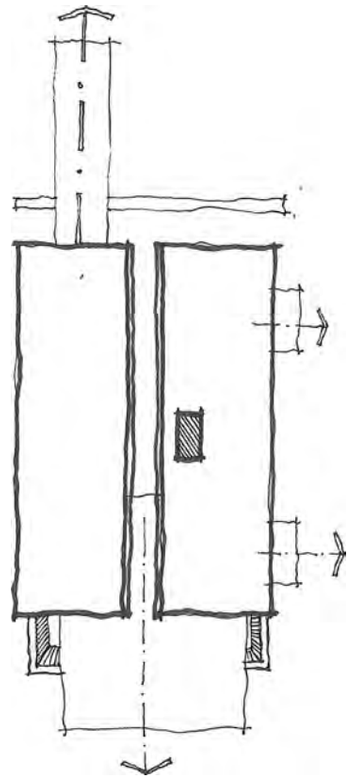
The third concept, that of the container and organic growth, developed from observing bacteria growing in a Petri dish, the way which microbiology researchers would do. The key ideas of this concept were creating extension, breaking boundaries, and generating a metaphorical notion of the spread of microorganisms. This concept became the primary focus of the initial thought-process, as it encapsulated the essence of the touchstone, and also incorporated the constructs of the other two aforementioned conceptual ideas. Existing features on the site, which were personally experienced as part of the cognitive site analysis, were interpreted as the containers from which growth can occur, and they therefore assisted in the initial development of the design process.

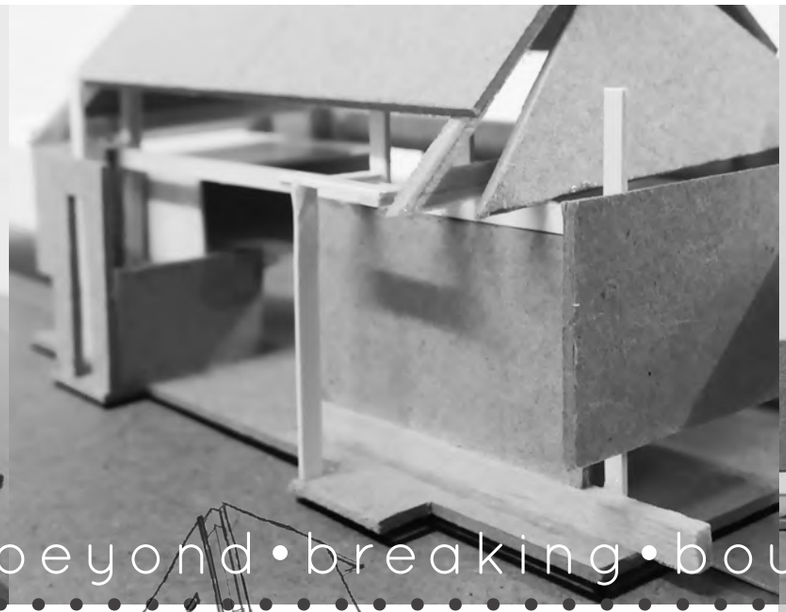
THE CONTAINER AND GROWTH

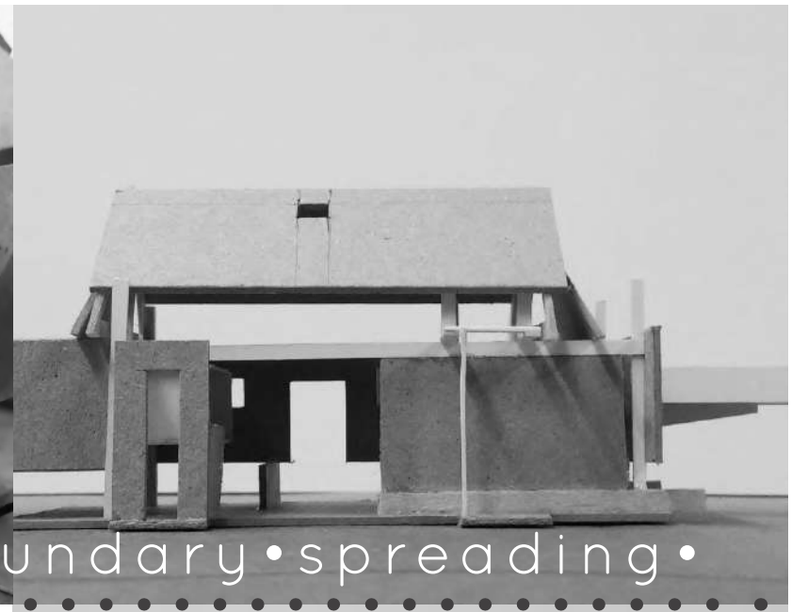




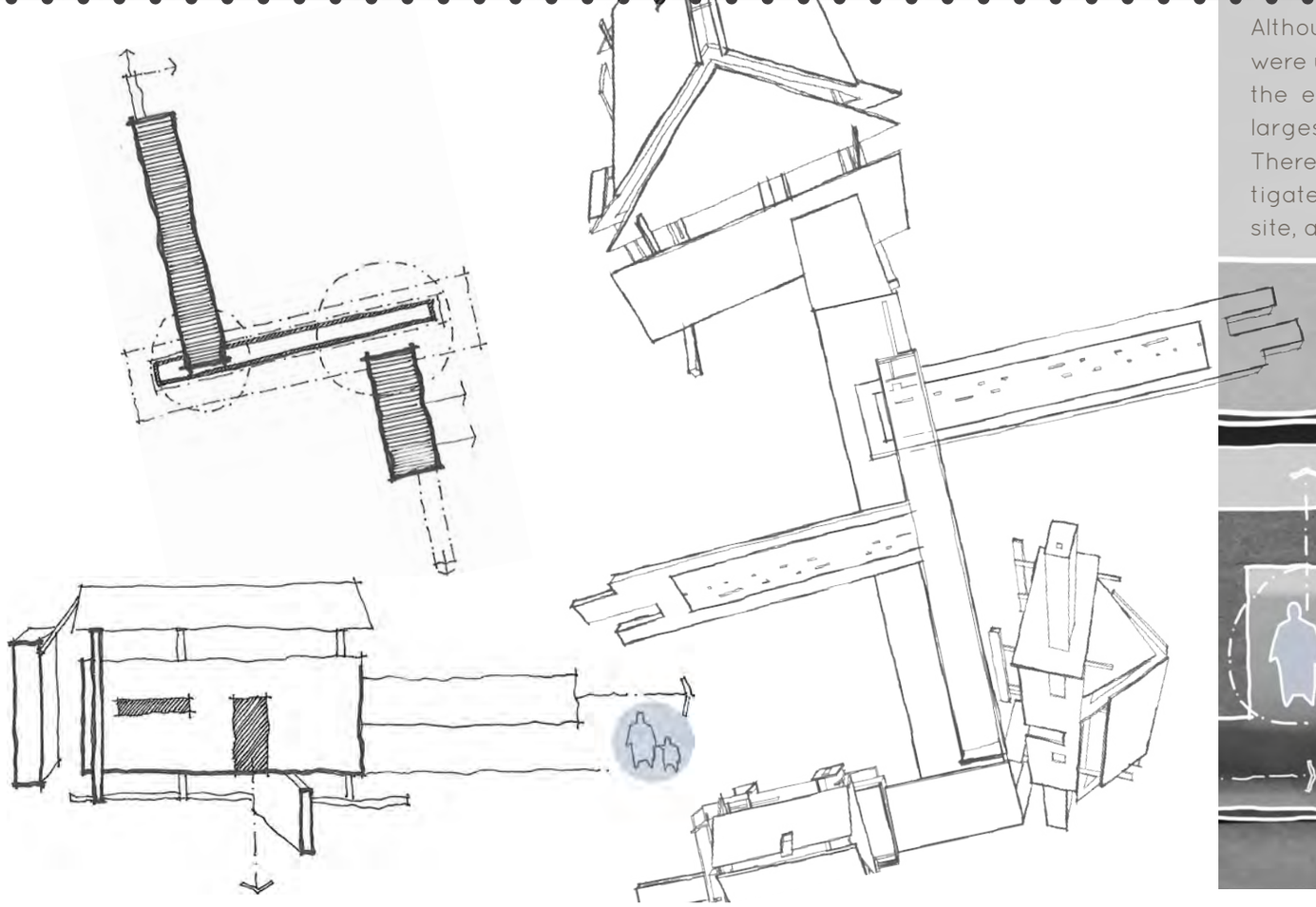




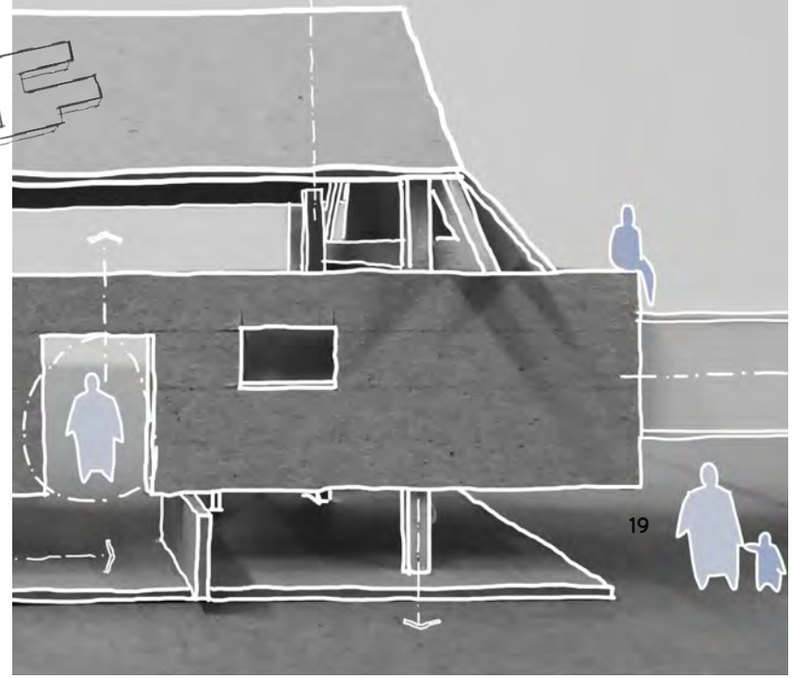




•extension•beyond•breaking•boundary•spreading•



Although principles from all the formative ideas were used, this concept, which was developed from the existing houses present on the site, had the largest influence on the initial design development. Therefore, the existing houses will be further investigated and developed through the analysis of the site, and the design synthesis, discussed in Part 3.



2.3 CONCEPTUAL FRAMEWORK

The conceptual framework is provided as a glossary, drawn from the initial formative ideas, as a means of approaching the problem statements and forming the main constructs of the unique design methodology. Essentially, it is a grouping of terms that drove certain conceptual notions about the scientific institute and associative laboratories. These concepts formed a way of thinking about scientific research and practices and the places within which these activities take place.

Microbial: A term referring to that which is related to or caused by microbes. In its simplest explanation, a microbe is a microorganism, especially a bacterium, which causes disease or fermentation. These minute organisms, invisible to the naked eye, make up a staggering component of our existence. As much as microbes are responsible for disease, they are also integral to our health and essential for the proper functioning of many bodily systems, such as digestion.

Alchemy: With its roots in medieval times, alchemy can be defined as a practice based on chemical science and speculative philosophy. It is broadly considered to be the forerunner of modern-day chemistry, and was previously perceived as a somewhat "magical art".

Amalgamation: An action, most often a process of reaction, of combining or uniting.

Cognitive dissonance: A kind of psychological tension, closely related to the concept of *unheimlich*, created by a feeling of experiencing something as both familiar and simultaneously unfamiliar.

Equilibrium: With connotations to calmness and serenity, equilibrium refers to a state of balance. Opposing forces or influences are reconciled to achieve what is fundamentally considered to be a condition of inherent stability.

Estrangement: In terms of this conceptual framework, estrangement deals with no longer being familiar with something; finding oneself in an unfamiliar, even uncomfortable environment that renders a sense of hostility.

Mysticism: For the purpose of this discourse, mysticism refers to that which is vague and ill-defined; not well understood and often associated with expressions of the occult.

Sorcerer: Someone who claims to have, or can be believed to have, certain magical powers.

Unheimlich: As much as it is a concept that cannot be conveyed so simply, the word can be translated from German to express that which is uncanny, unfamiliar and weird. The term is related to more intricate spheres of Freudian psychology, dealing primarily with secrecy and fear.

The formation of this conceptual glossary has been broadly based on the sources collected and read that are referenced in the bibliography. Therefore, the glossary can be described as a personal understanding of the different interests that drove the investigation of the project and associated fields, and is intended as an introduction of the notions that will be further explored throughout the discourse.

IMAGE (LEFT): "Stone Balance" by artist Michael Grab, who creates rock sculptures using only gravity as the "glue" to keep these compositions together, using the constructs of balance and equilibrium. *(Source: Gravity Glue - http://www.gravityglue.com/ - 1 June 2015).*

2.4 TYPOLOGY

2.4.1. INVESTIGATING THE CLIENT AND USER

The NICD is the national public health institute in South Africa that operates as a sector of the National Health Laboratory Services (NHLS), and which provides reference with regard to microbiology, virology, epidemiology, surveillance and public health research to support the government's response to threats of communicable disease. The NICD is organised into functional centres, bringing together expertise in the fields of microbiology and epidemiology to enable an integrated public health response. Primarily, the NICD supports the programmes initiated by the national and provincial Departments of Health of South Africa, and also provides public health services, such as ensuring collaboration of laboratory functions with global programmes of the World Health Organisation (NHLS, 2015: online).

The NICD is intended to be a resource of knowledge and expertise to the South African government in relation to regionally relevant communicable diseases, and was established to function as a laboratory-based national facility distinct and independent from the existing microbiology and virology laboratories attached to academic centres throughout the country. Rather than being a patient-oriented clinical diagnostics entity, the NICD has been modelled largely around the Centres for Disease Control and Prevention (CDC) in the USA (NHLS, 2015: online).

The primary aim of the NICD is to be the "organ" for public health surveillance of communicable diseases in South Africa, by collecting, analysing and interpreting data on an ongoing and systematic basis. Research is conducted around the monitoring of the emergence of new infectious diseases and the re-emergence of previously controlled diseases, as well as the effects of foreign, exotic infectious diseases. It is this research that makes it possible for the NICD to succeed in the early detection of outbreaks and epidemics, enabling a timely and effective government response to outbreaks. Therefore, it is also the responsibility of the NICD to establish efficient structures for the rapid and continuous distribution of data and information to all those that require it (NHLS, 2015: online). The NICD works within an integrated network that is supported by private and public laboratories throughout the country.

It is for this reason that the NICD requires an additional facility at a central location that can assist in effective communication between integrated parties. The programmatic implications for this client involve the construction of a laboratory focused on microbiology research, data and statistics, which requires specialised equipment and ancillary services. It is fundamental that this facility caters well to the staff who will occupy it. Because of the sensitive nature of work conducted within such a facility, no matter the aims of "humanising the scientific institute"; safety and security remain integral features in terms of this type of building.

INTENDED USERS:

THE SCIENTIFIC RESEARCHER,
AS EMPLOYED BY THE INSTITUTE

THE POST-GRADUATE STUDENT,
A YOUNG SCIENTIST IN TRAINING

THE "EVERYDAY" PERSON,
INTERESTED IN LEARNING

THE GARDENER, AS HIRED BY
THE INSTITUTE OR A VOLUNTEER

2.4.2. EXPLORING SIMILAR BUILDING-TYPES: PRECEDENT STUDIES

In order to understand the typological implications of designing a scientific institute of this nature, that is, an institute that deals with microbiology and biochemistry research and experimentation, existing local architectural examples were studied as a means of investigation. South Africa has a specific and sensitive relationship with disease and the study thereof. Bearing in mind that a person's ability to live with and treat a disease is directly dependent on the level of care that that person can afford, the study of microbial organisms in South Africa, a country of great economic inequalities, needs to take social aspects into consideration.

FIELDS OF RESEARCH INTERLINKED WITH MICROBIOLOGY THAT ARE FOCUSED ON MICRO-ORGANISMS AND DISEASE-CONTROL:

epidemiology:

the branch of medicine that deals with the incidence, distribution, and possible control of diseases and other factors relating to health.

biochemistry:

the branch of science concerned with the chemical and physiochemical processes that occur within living organisms.

helminthology:

the study of parasitic worms or helminths. This field deals with the study of their taxonomy and the effect on their hosts.

The good scientist does not know what she will get. Here comes the scalpel, the whirr, the laser. Blood separation uncovers, discovers. The terrible thing: it was there all along, and at last it can be seen. Reproduced a million times over so that it can be contained, so that it can be made harmless; at its heart lies a code that can be extracted and neutralised. Nascent potential. Reveal yourself, virus.

Are you listening Bob? **The building is a virus**, *not a duck...*

(Coetzer, 2007: 89).

medical entimology:

the branch of science that deals with insects that cause disease or that serve as vectors of organisms that cause disease in humans.

microbiology:

the branch of biology dealing with the structure, function, uses, and modes of existence of microscopic organisms.

study of zoonoses:

zoonoses are infectious diseases that are transmitted from animals (normally vertibrates) to human beings.

NEW OFFICES AND QUALITY CONTROL LABORATORY FOR THE BIOVAC INSTITUTE (PHASE 1).

StudioMAS ARCHITECTS AND URBAN DESIGNERS.

LOCATION: PINELANDS, CAPE TOWN.

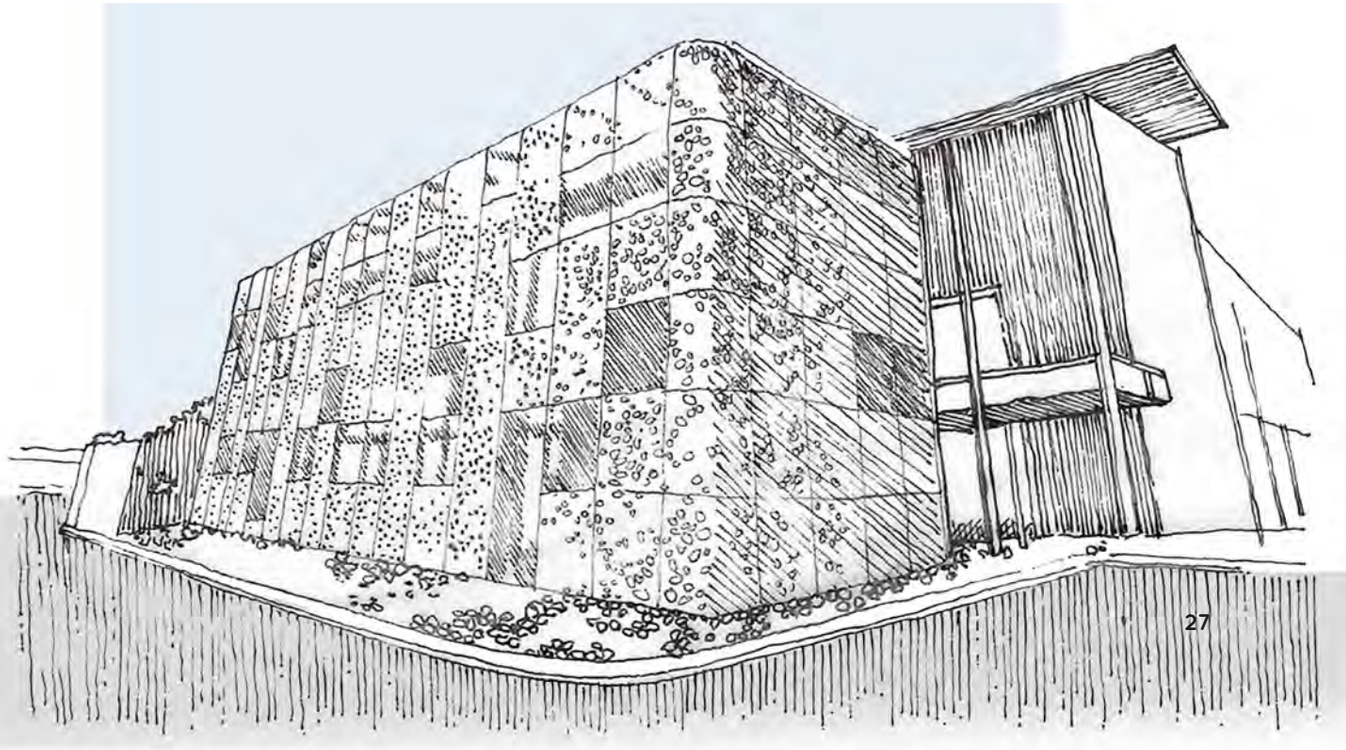
COMPLETED: 2007.

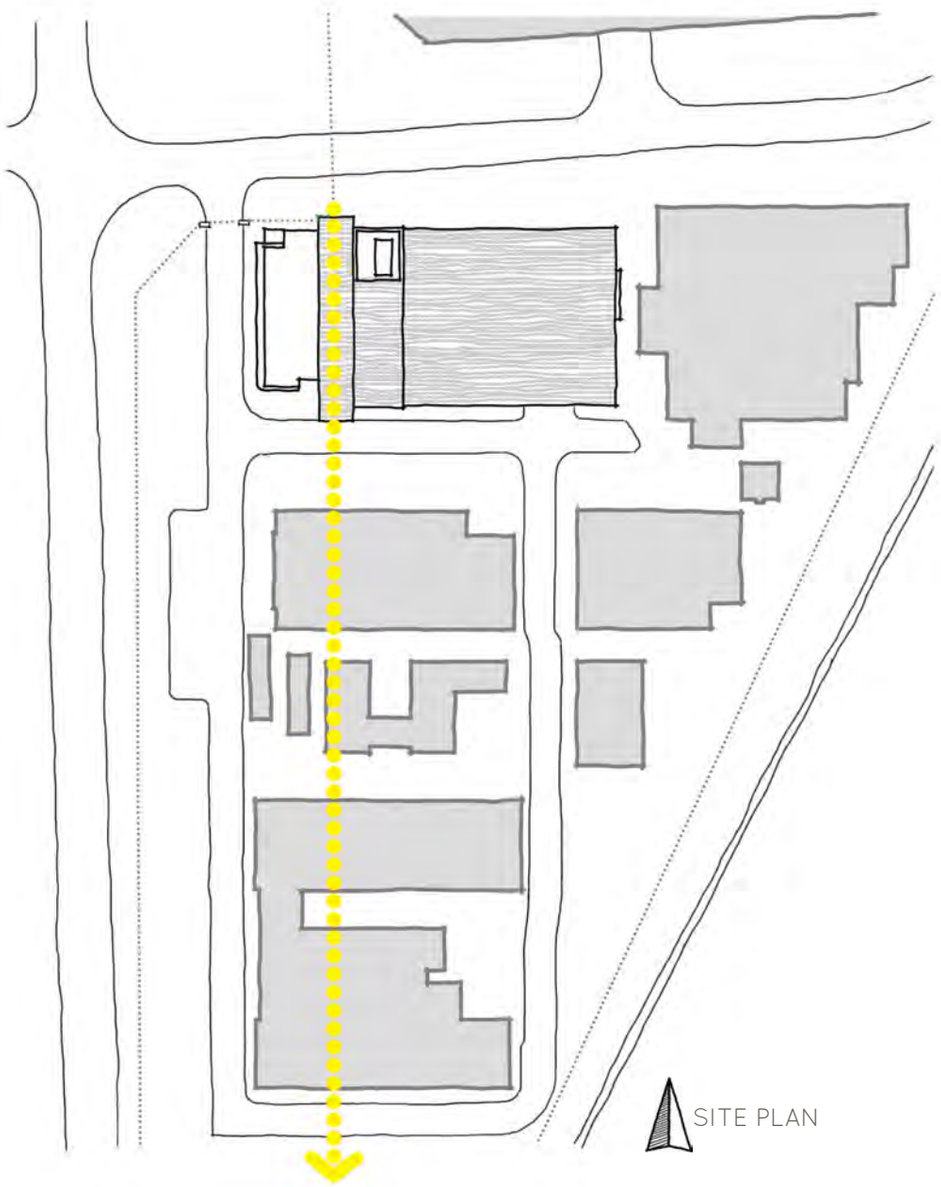
IMAGE (LEFT): Aerial view of Pinelands, Cape Town. *(Source: Google Maps - https://www.google.co.za/maps/place/Pinelands,+Cape+Town,+7405/@-33.93453,18.509408,915 - 28 February 2015).*

2.4.2.1. OFFICES AND LABORATORY FOR THE BIOVAC INSTITUTE

The Biovac Institute is a private company, relying on international funding. StudioMAS Architects and Urban Designers were requested to design a new, functional, clinical quality control (QC) laboratory that had to comply with rigorous international standards, so that the Institute would be authorised and accredited with the right to test vaccinations in South Africa (Tondeschino, 2007: 104). The function of quality control hints at the kind of controlled environment that was required for the interior.

The brief asked for a single-storey laboratory building and adjoining small office component, which was to take advantage of west-facing views, therefore creating the challenge of providing adequate sun protection. The laboratory was viewed as the primary priority because of the tight budget of the project, while the scheme as a whole developed in phases once the testing rights were awarded to Biovac. Therefore, the long-term vision had a significant influence on the master-planning as well as overall branding of the building (Tondeschino, 2007: 104).



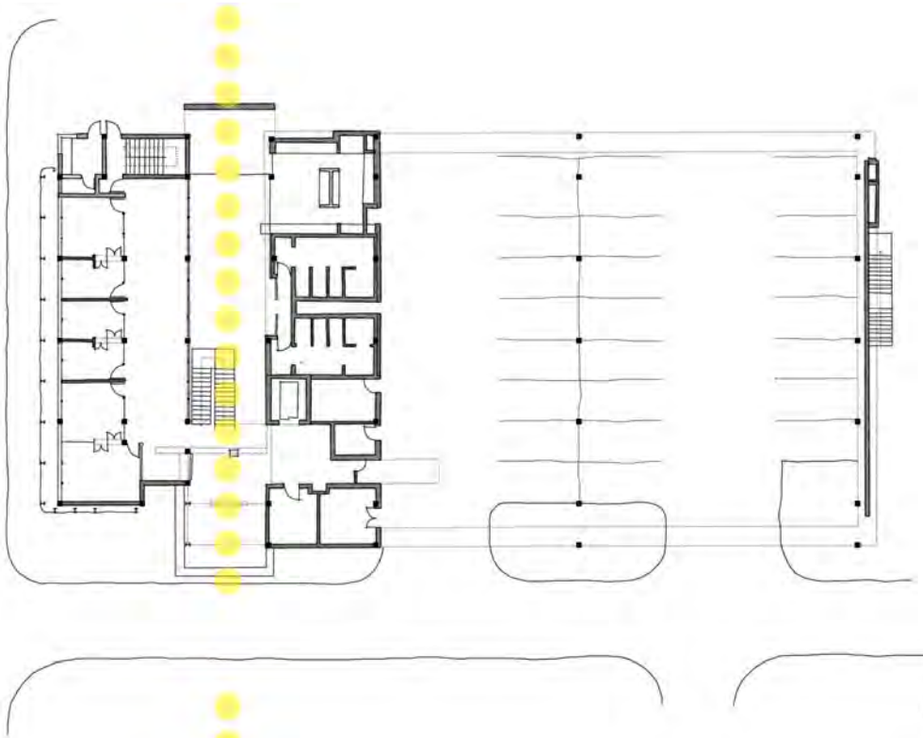


PLANNING AND PRAGMATICS: FUTURE DEVELOPMENT

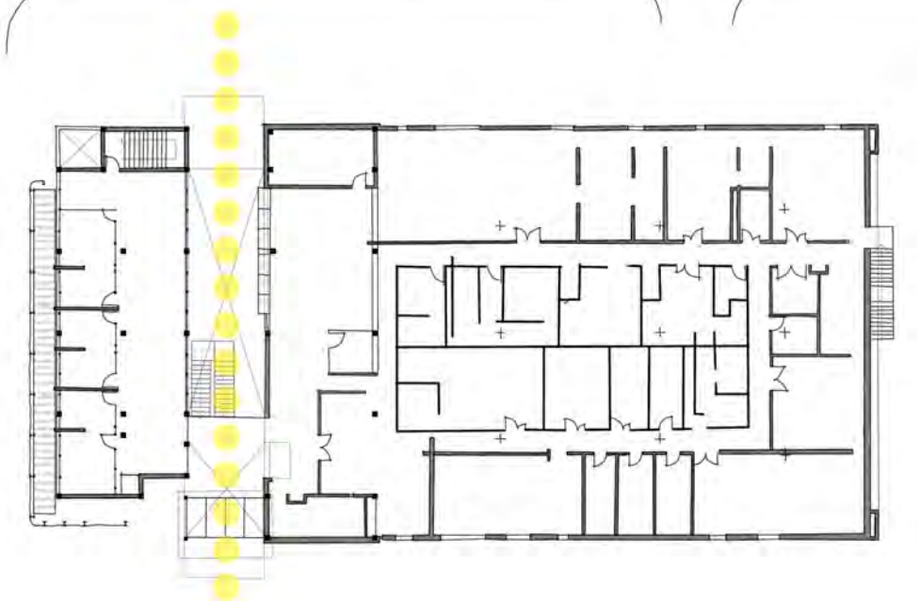
The master plan allows for existing structures and houses to be demolished. The site was developed by implementing a framework for future growth, utilising a street as an ordering principle, and therefore generating a spine. This spine is intended to tie future buildings together, and forms the main route of circulation for staff and services. The spine is intended to vary between indoor and outdoor spaces, and accommodate more interactive functions, such as canteens and reception areas.

PLANNING AND PRAGMATICS: FUTURE DEVELOPMENT

The complex itself has a simple layout, consisting of a laboratory block and a street and office block with a sun-control skin. The laboratory was designed to be elevated by a full floor, which allowed for the possibility of transforming the parking that comprises the ground floor into another laboratory in the future. The offices are then pulled away from this space on both levels to create the aforementioned “street” or spine.



GROUND FLOOR PLAN

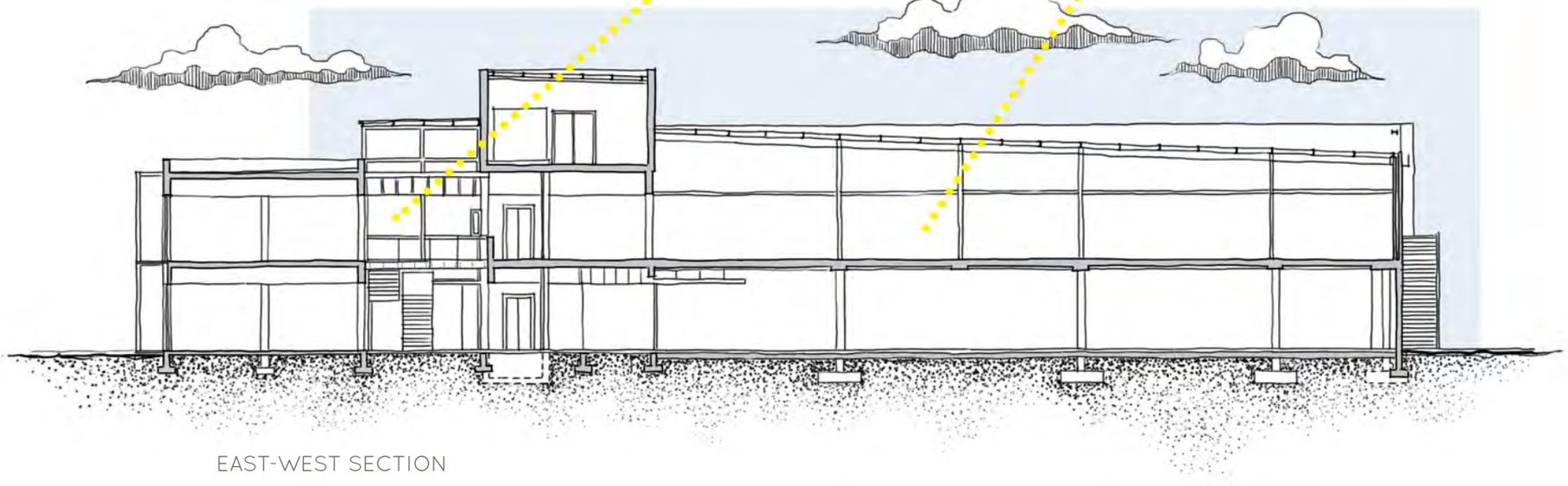


FIRST FLOOR PLAN

OPENINGS

The design of the complex adheres to an ideal of form-follows-function, and windows were cut into laboratory wherever required from the interior. Glazing and a long slot window is intended to create interaction between the laboratory spaces and offices and sunscreen. Furthermore, these surfaces are intended to reflect the context of small-scale house and physical attributes of Alexandra Street from the first-floor bridge (Tondeschino, 2007: 104).

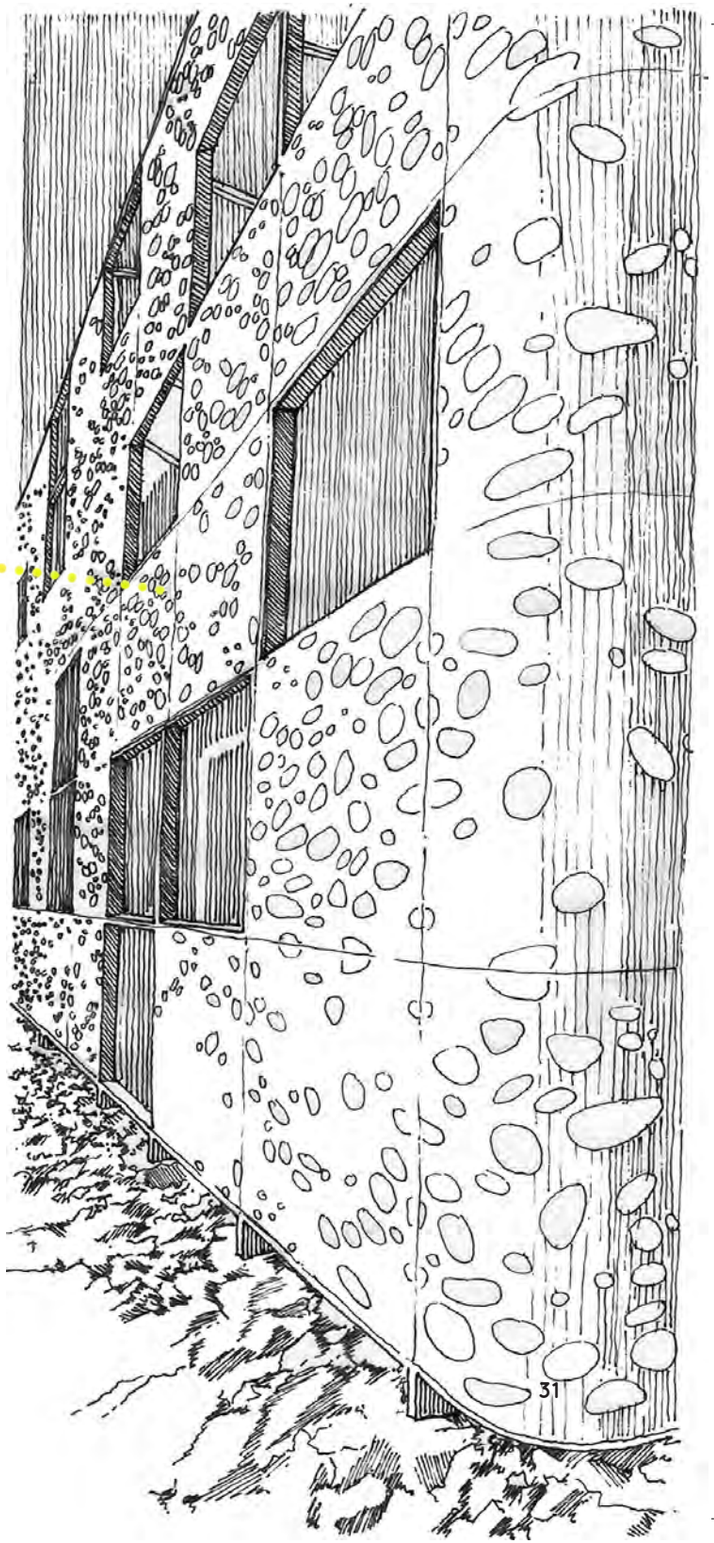
(Image source: StudioMAS online - http://www.studio-mas.co.za/biovac-phase1.php - 28 February 2015).



EAST-WEST SECTION

THE SUNSCREEN

The client requested that the offices be located on the west to take full advantage of the views over the site, which naturally conflicts with principles of sun control. Nonetheless, this resulted in the opportunity to unite branding and sun control, and gives the building an iconic quality. A skin was devised to control the infiltration of heat and light, which is separated from the fenestration by a walkway, allowing for both a place of break-away and a means of maintenance (Tondeschino, 2007: 104).



The specific pattern that appears on this outer skin was generated from a highly magnified image of a blood-tissue sample and wrapped around the western façade. Certain panels were removed in a somewhat random manner, still maintaining the structural integrity of the skin to break the monotony of the membrane and begin playing on ideas of layering and frames of view.

Because of the movement of the sun across the site during the day, filtered images and patterns of light and shadow "infect" the offices, so to speak, and also seep through into the spine and laboratory block further back. The ultimate intention is that future developments on the site will adhere to similar design principles, so that this image will continue to transform, grow and spread to other spaces and places.

(Image source: StudioMAS online - http://www.studiomas.co.za/biovac-phase1.php - 28 February 2015).

NATIONAL TUBERCULOSIS REFERENCE LABORATORY.

StudioMAS ARCHITECTS AND URBAN DESIGNERS.

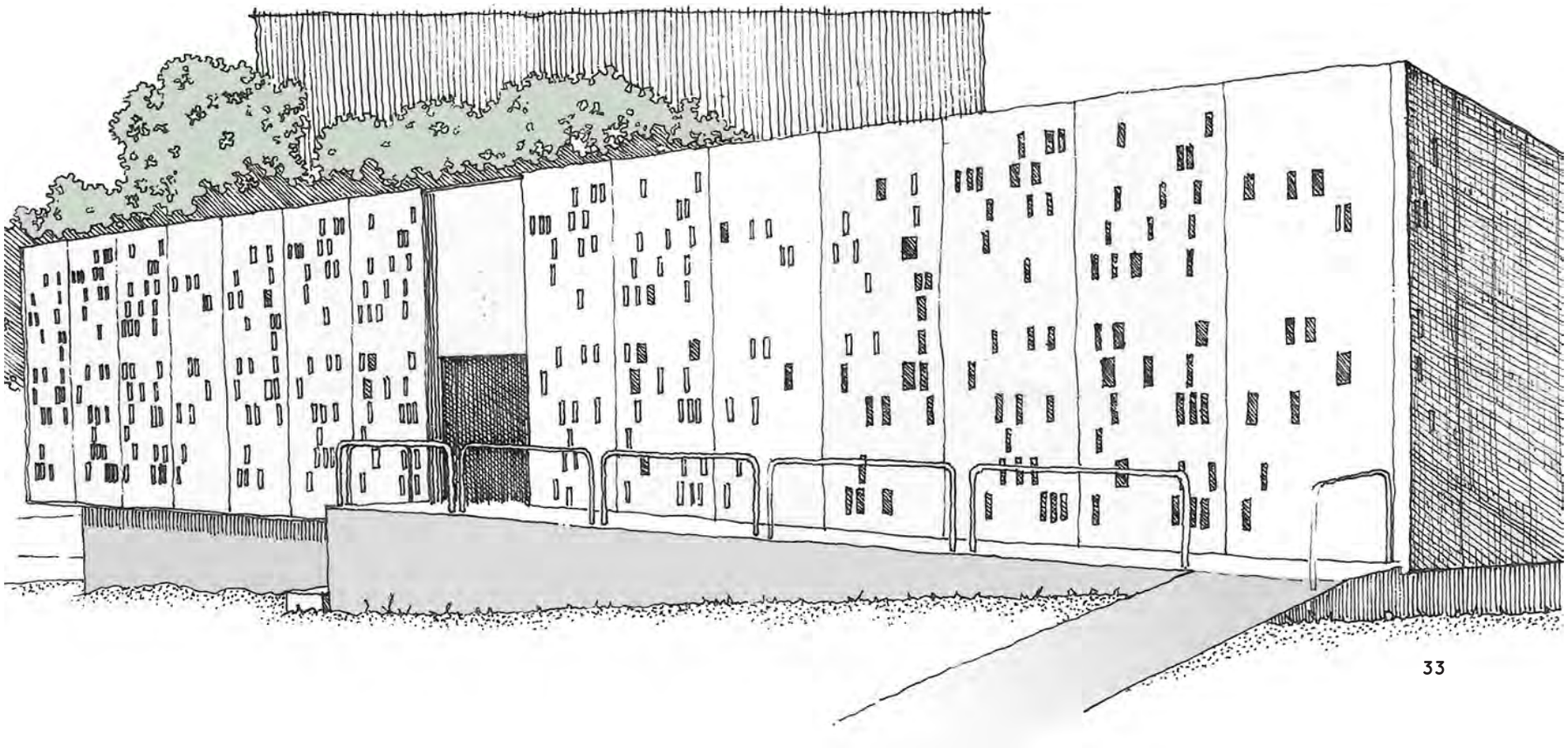
LOCATION: SANDRINGHAM, JOHANNESBURG.

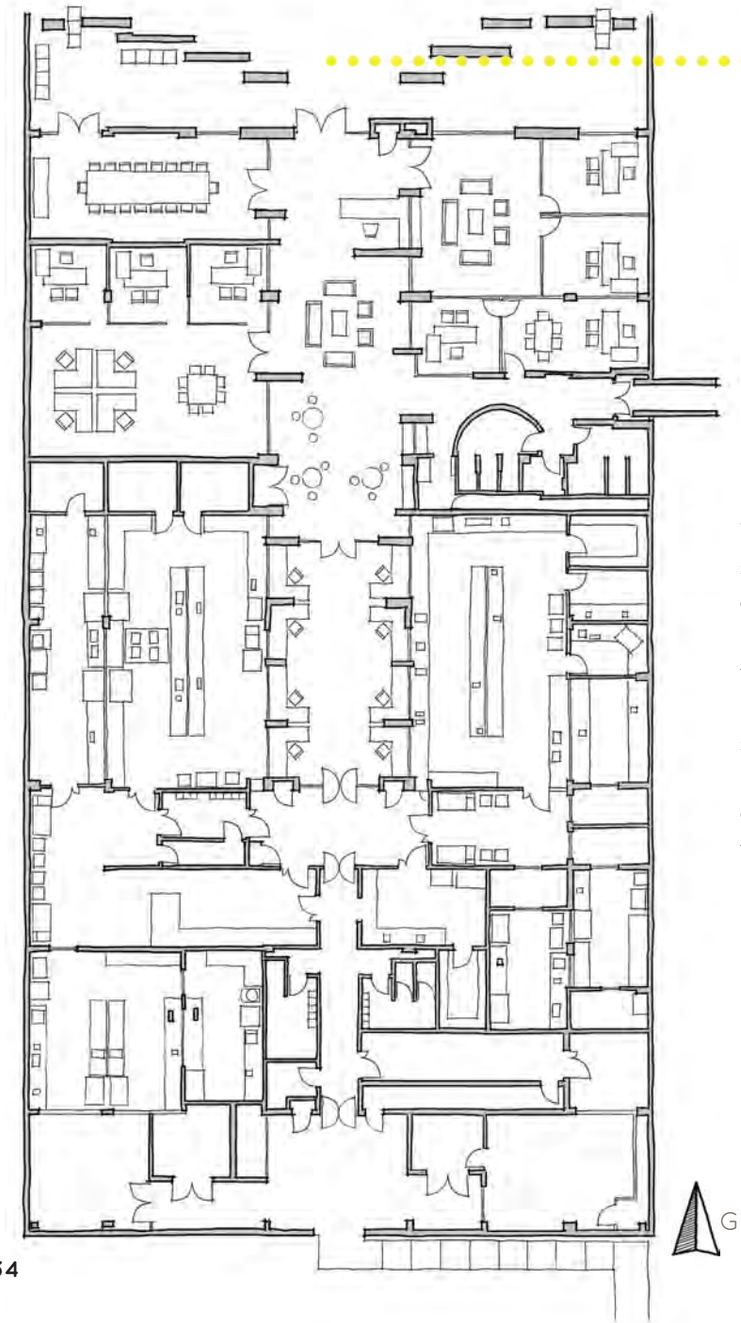
COMPLETED: 2009.

IMAGE (LEFT): Aerial view of Sandringham, Johannesburg. *(Source: Google Maps - https://www.google.co.za/maps/place/Sandringham,+Johannesburg,+2192/@-26.1450079,28.1084215,16 - 28 February 2015).*

2.4.2.2. NATIONAL TUBERCULOSIS REFERENCE LABORATORY

The National Health Laboratory Services (NHLS) campus in Johannesburg put forward the requirement to StudioMAS Architects and Urban Designers for a specialised tuberculosis laboratory, which was needed because of the significant growth and spread of communicable diseases in southern Africa over recent years (Peres, 2009: 22). The task was complicated because, in order to maintain the specific interior conditions necessary for such laboratories, the structure had to be precise and detailed, and this obligation resulted in the challenge of merging intricate service requirements with a poetic spatial quality. In this way, this building shares a similar aim to the project proposed in this dissertation.

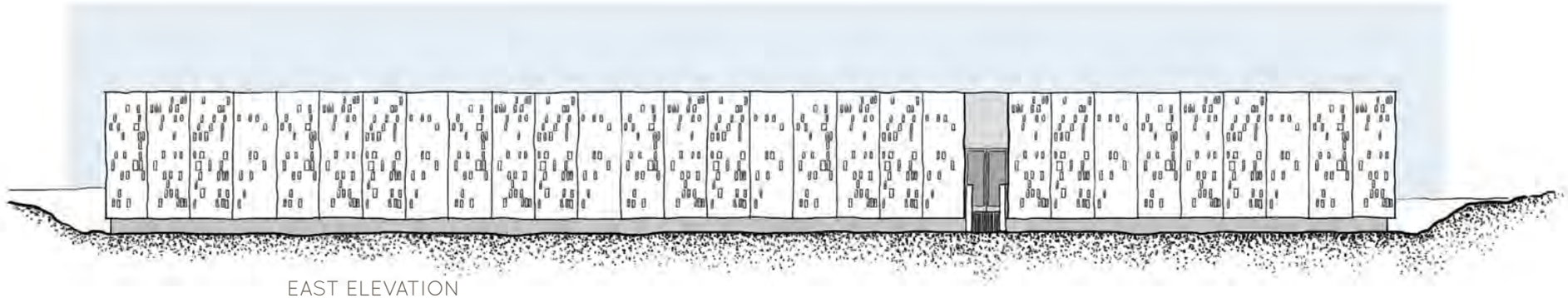




GROUND FLOOR PLAN

PLAN RELATING TO CONTEXT

The campus is situated in a rural residential context. This specific building is situated at the main entrance to the campus, and therefore acts as a landmark structure that highlights entry into the precinct within this specific context. The building is horizontally proportioned, with its placement responding to the steep east-west slope of the site. It is not north-facing, but rather runs parallel to the main road, with the intention of inviting passers-by, whether vehicular or pedestrian, to experience the character of the building (Peres, 2009: 22).



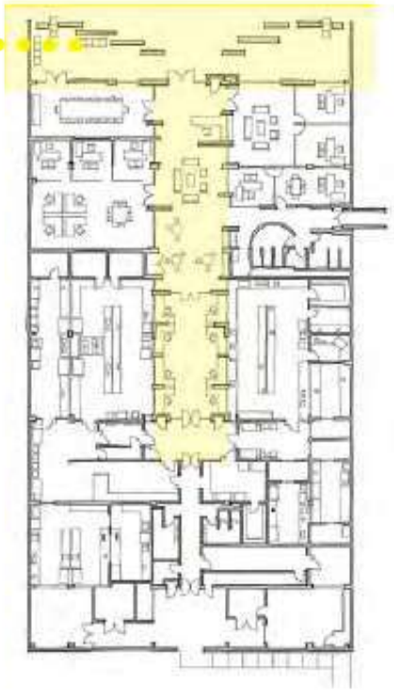
EAST ELEVATION

DESIGN CONCEPTS

Initially, the building seems austere and detached from a sense of humanity. Nonetheless, the design incorporates concepts of morphing and change to create an architectural dialogue that can be related to. Note that this building does not house public functions, or functions that facilitate public interface. Therefore, during the day, the surface of the building is monochromatic, and it shields the seriousness of the scientific research taking place on the interior. During the evening the building changes into a more playful structure, with an interchange of colour and light against the night sky (Peres, 2009: 22).

Because of the private nature of its inner proceedings the essential feature of the building is, rightly, the façade – it is the primary element that communicates with the broader public. It consists of a series of four-tonne precast concrete panels, each 5m high, with a specific pattern punched through the surface to create the rectangular openings that are visible. The particular DNA code of the tuberculosis virus is the template for these rectangular openings, and although appearing completely random, is representative of a pattern that reveals itself in the natural, organic environment (Peres, 2009: 22). This pattern is repeated on the north, east and west elevation surfaces. Furthermore, these openings then become the picture frames of the surrounding scenic landscape. Filtered, multi-coloured glass pieces allow for various lighting effects on the inside, and bring a sense of warmth to an austere interior (StudioMAS, 2009: online).

(Image source: StudioMAS online - http://www.studiomas.co.za/nicd-laboratory.php - 28 February 2015).

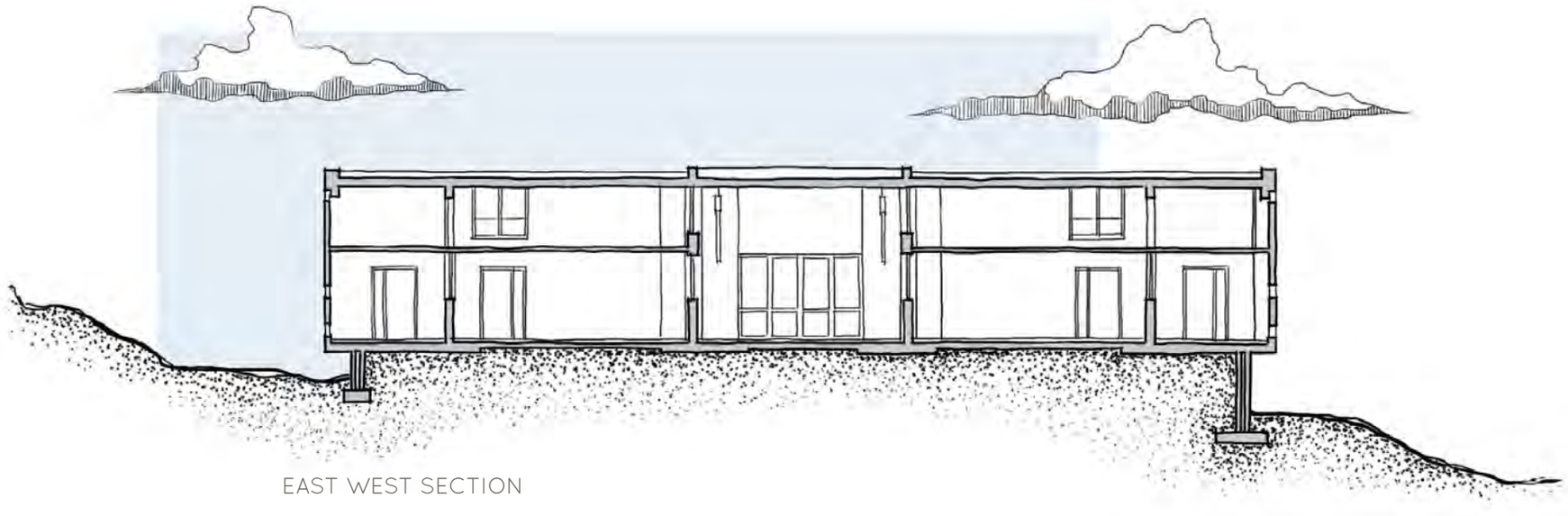


SPATIAL TRANSITION

The building, which is entered from the north on one of the narrower sides of what is essentially a rectangular form, is spatially graded. The entrance is more public, with spaces that allow employees (not the general public) to mingle and relax in lounge areas. More private work areas are found beyond, with a well-lit central corridor running along the length of the building, connecting laboratories and offices spaces on either side (Peres, 2009: 23).

There is no need for openings from the interior to outside, because of the functional requirements of the laboratory, that specifies a pristine, contained environment determined by the nature of work conducted inside (StudioMAS, 2009: online). The research work is somewhat demanding, and therefore requires highly specialised interior spaces. These spaces are however brightened by the design and are intended to be pleasant for staff and conducive to reducing the stress of the working environment.

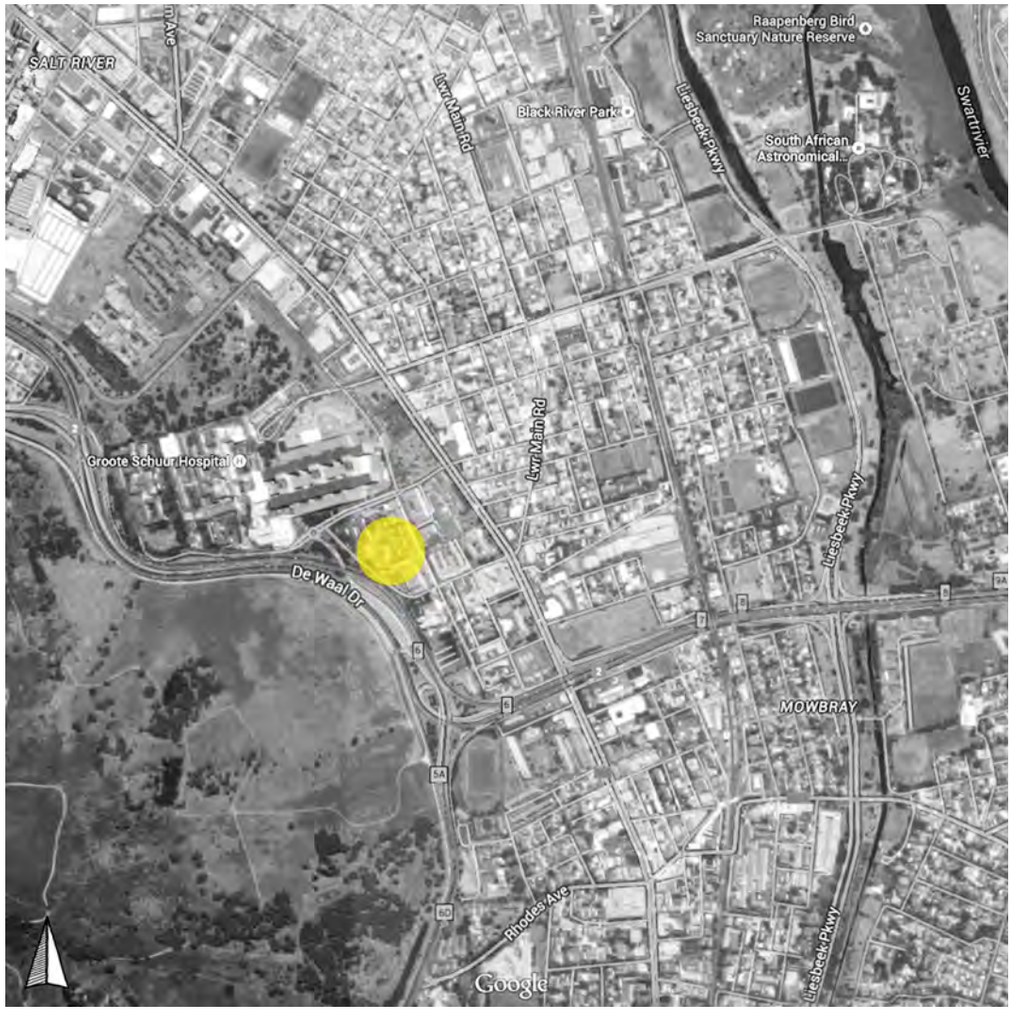
(Image source: StudioMAS online - http://www.studiomas.co.za/nicd-laboratory.php - 28 February 2015).



EAST WEST SECTION

TOWARDS AN APPLICABLE DESIGN METHODOLOGY

The claustrophobic environment and atmosphere associated with laboratory spaces is lessened by the playful character of the façade and the way in which a relationship is created between the human world and invisible realm of disease. The laboratory meets both the functional and poetic demands of the brief, and promotes a comfortable and stimulating workplace for staff who work hard at tackling some of the country's most pressing health problems.



LINK BUILDING FOR THE INSTITUTE OF INFECTIOUS DISEASE AND MOLECULAR MEDICINE.

GABRIEL FAGAN ARCHITECTS.

LOCATION: UNIVERSITY OF CAPE TOWN NEAR GROOTE SCHUUR HOSPITAL, CAPE TOWN.

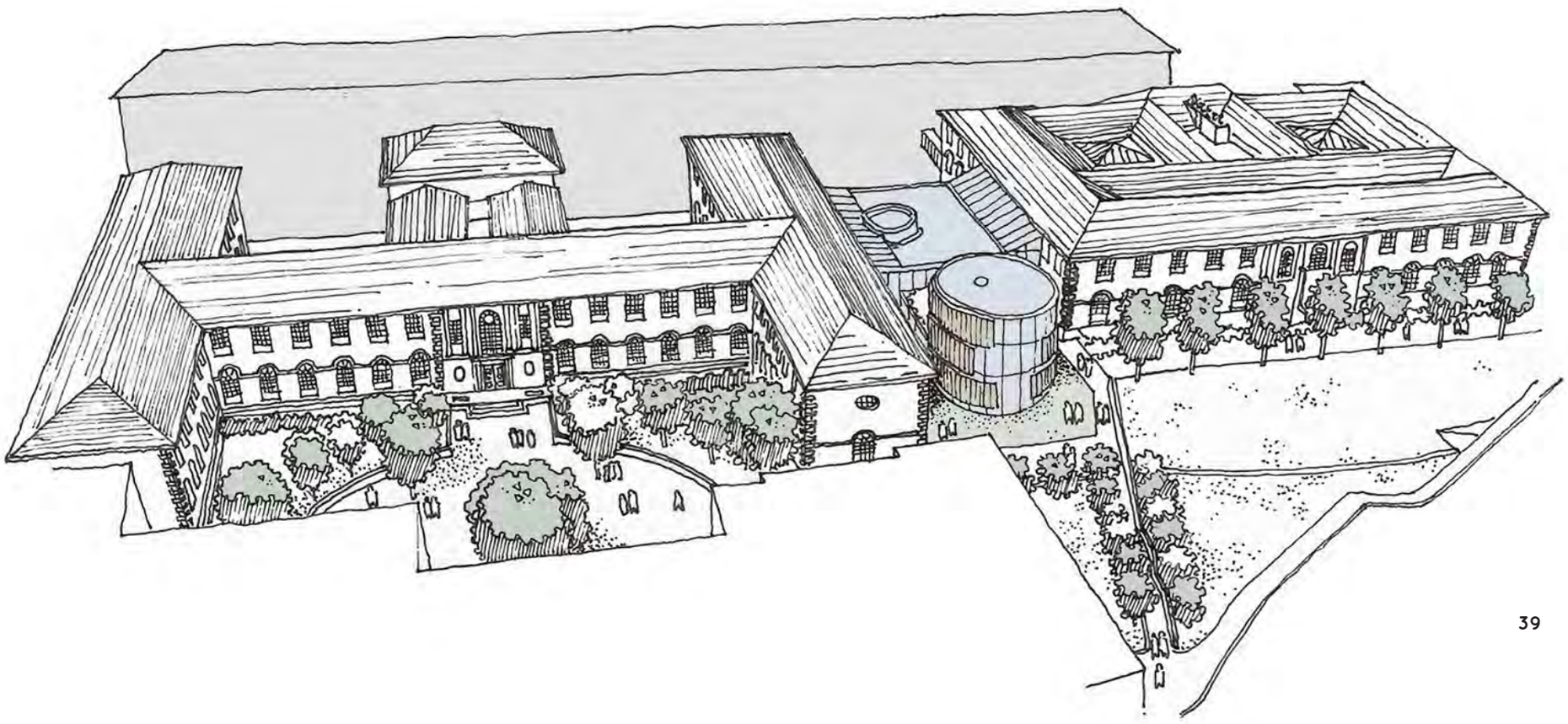
COMPLETED: 2005.

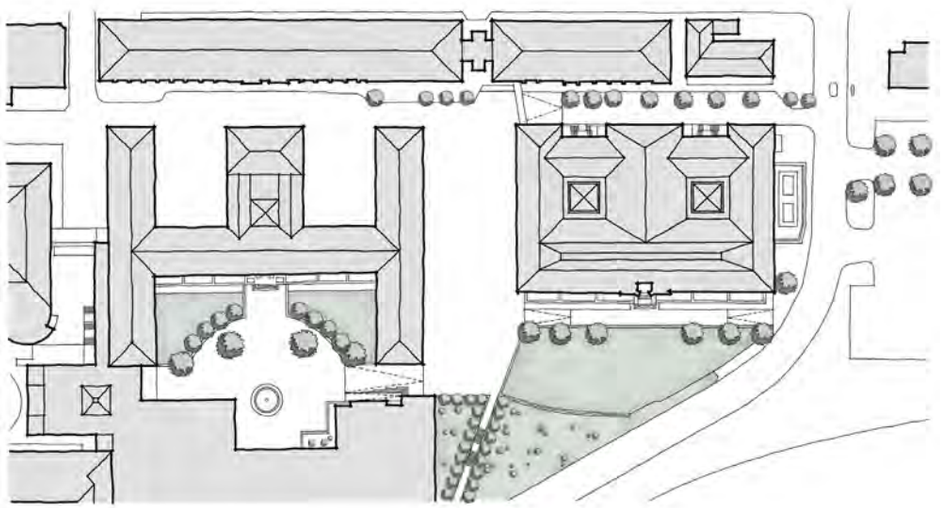
IMAGE (LEFT): Aerial view of Observatory, Cape Town. *(Source: Google Maps - https://www.google.co.za/maps/place/Observatory,+Cape+Town,+7925/@-33.93809 5,18.47392 3,15 - 28 February 2015).*

2.4.2.3. INSTITUTE OF INFECTIOUS DISEASE AND MOLECULAR MEDICINE

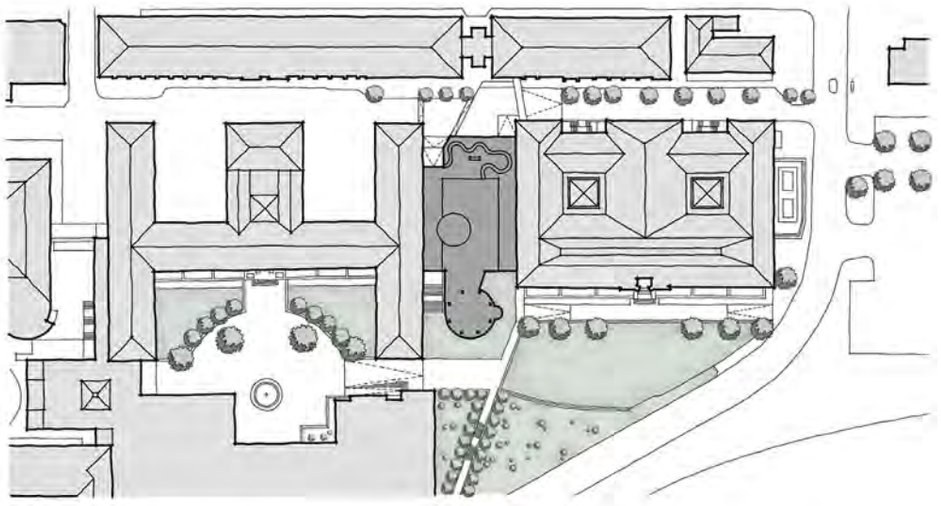
The Institute of Infectious Disease and Molecular Medicine, spread across three separate buildings, commissioned this pavilion structure as a physical and symbolic link of its activities. It is this link that encourages valuable informal interaction between colleagues and heightens the feeling of community within the Institute (Deckler, Graupner, and Rasmuss 2006:101).

Gabriel Fagan Architects designed this merit-award-winning Link Building for the University of Cape Town's Institute of Infectious Disease and Molecular Medicine, near Groote Schuur Hospital. The proposed site for the centre for disease control in this dissertation is also situated in close proximity to a hospital and educational institutions (as is with the context of the project proposed in this dissertation).



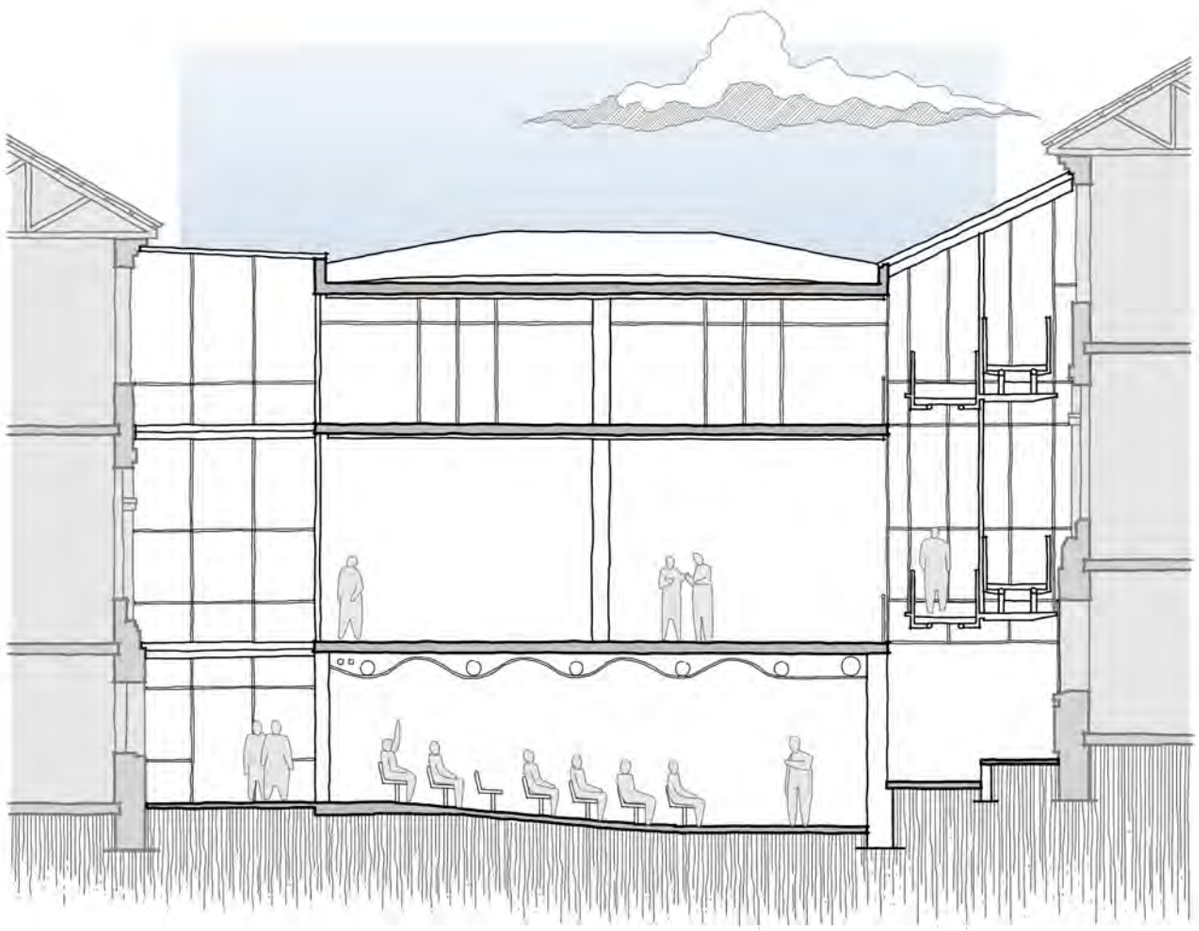


SITE PLAN PRIOR TO THE ADDITION OF THE LINK BUILDING



THE ADDITION OF THE LINK BUILDING AS A UNIFIER

The brief required that the intervention tie the disparate buildings of the Institute into a cohesive complex (De Beer, 2014: 90). It bridges the 18m space between the two existing structures of the Institute. The design of the Link Building, in summation, provides the existing Institute buildings with offices, vertical circulation spaces, a café and an internet café. Ultimately, Fagan's Link Building is intended to create a new public interface and entrance for the Institute. Therefore, this building was chosen as a precedent due to its capabilities of demystifying the typical institution and deeming it a more publicly accessible building.



CROSS SECTION: existing neoclassical buildings on either side

THE "TEMPIETTO"

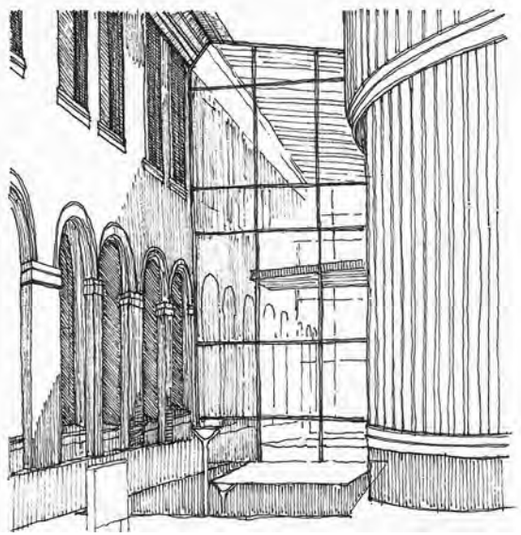
The glass *tempietto* is the most prominent part of the building and, according to Coetzer (2007:35), it functions simultaneously as an icon, as a symbol and as the glue joining three existing but disparate, incongruent buildings. Traditionally, in architecture, a *tempietto* is a small, temple-like building. The term resonates ideas of Donato Bramante's Tempietto in San Pietro, Montorio, Rome, built in 1502. The small chapel is built on a circular plan and is surrounded by columns of the Doric order, surmounted by a dome (not, however, seen in Fagan's interpretation). It is considered to be one of the finest architectural examples of the High Renaissance for its elegant reinterpretation of classical principles. Bramante intended for the design to find architectural reconciliation between Christian and humanist ideals by incorporating the "perfect proportional" system – the Golden Section. These proportions determine all of that in the natural world (i.e. the human world) and were, according to classical and Renaissance Christian beliefs, bestowed upon man by divinity. Therefore, an architectural expression thereof – the ultimate goal of Renaissance architecture – was seen as a means of uniting these two realms (Jones, 1990: 14). Fagan's cylinder was later named the Wolfsan Pavilion, and is successful in creating identity as well as celebrating the inner activities. It becomes the core from where the other buildings are accessed (De Beer, 2014: 90).

IN CONTEXT: CONTRASTING MATERIALS

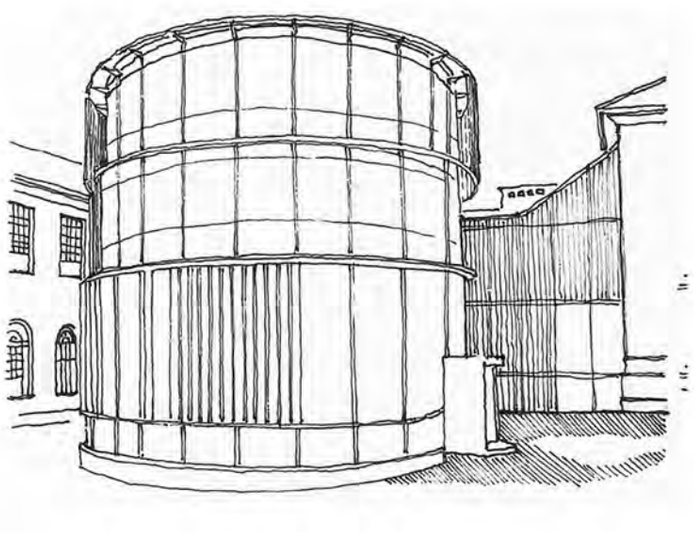
The glass and steel structure of Fagan's *tempietto* is in stark contrast to the plasterwork and beige paint finishes of the surrounding buildings that date from the Edwardian era. The Werner and Beit North and South Buildings, the separate adjacent buildings of the Institute that Fagan's building is intended to link, were constructed in 1925, and other than serving as examples of neoclassical architecture in South Africa, have limited architectural worth (De Beer, 2014: 90). Furthermore, the form that is this circular drum breaks away from the institutional, orthogonal context that surrounds it – perhaps even distracts from it – once again breaking primitive ideas of the kind of morphology that an institution should entail. Instead, Fagan's building works as a symbol of unification.

In terms of meaning, and the way meaning is attached to certain materials, the language of glass and steel is intended to symbolise the dominance of the microscope in this field of study as well as the generally large role of high technology within this context of molecular medicine. There is further reference to the role of technology in the mechanised sunscreens that can enclose the glass cylinder. Devil's Peak can be viewed to the west, providing the opportunity for splendid views, but also presenting the challenge of blocking out the intensity and heat of the South African sun.

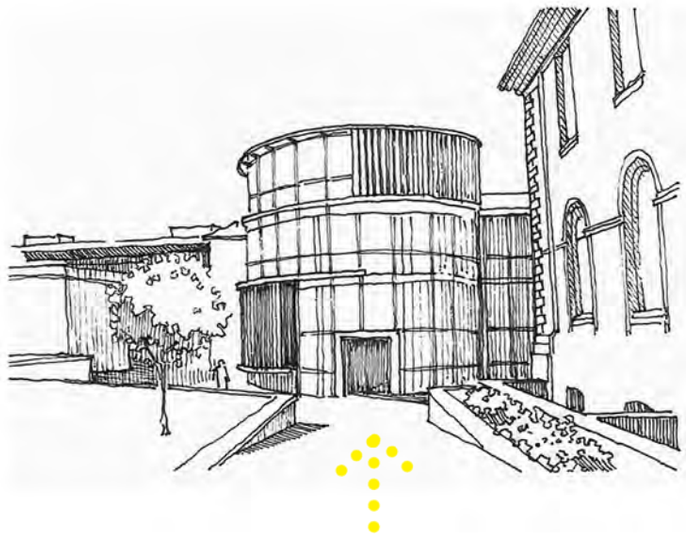
The materials used allow the pavilion to dominate without it being overbearing: it clearly denotes an entrance but also allows space to flow around it. The experience of the pavilion is multi-layered and it reveals different relationships between buildings. The use of glass allows the structures to reveal what is behind them, and creates a kaleidoscope of the physical and reflected; bending the perception of spaces and creating a dialogue between solid and void (De Beer, 2014: 90). It is this element of reflection that allows the new to interact and also celebrate and extend the old. The positive definition of space would not have been achieved with the insertion of a complete, solid building (Deckler, Graupner and Rasmuss, 2006: 101). It is the notion of transparency that creates soft boundaries and that blurs the idea of distinct, separating thresholds.



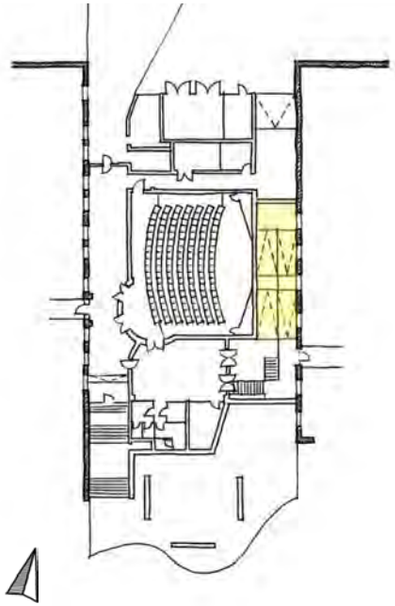
THE USE OF STEEL AND GLASS CONTRAST THE PLASTERWORK OF THE EXISTING BUILDINGS



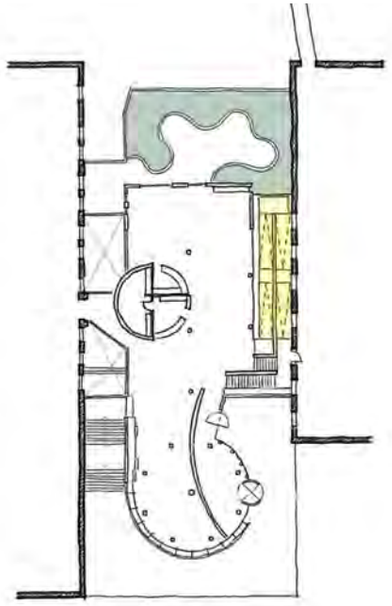
MECHANISED SUNSCREENS ENCLOSE THE GLASS CYLINDER



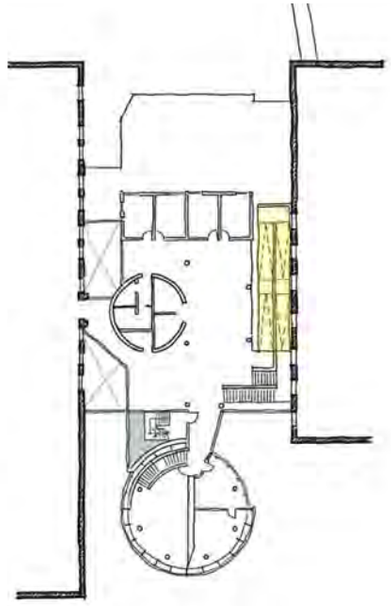
APPROACH INTO THE CYLINDER



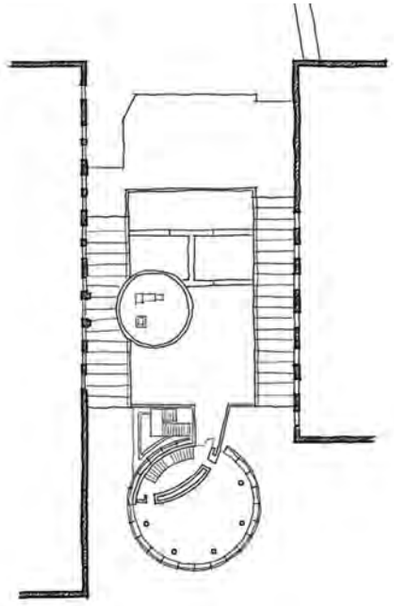
LOWER GROUND FLOOR



GROUND FLOOR



FIRST FLOOR

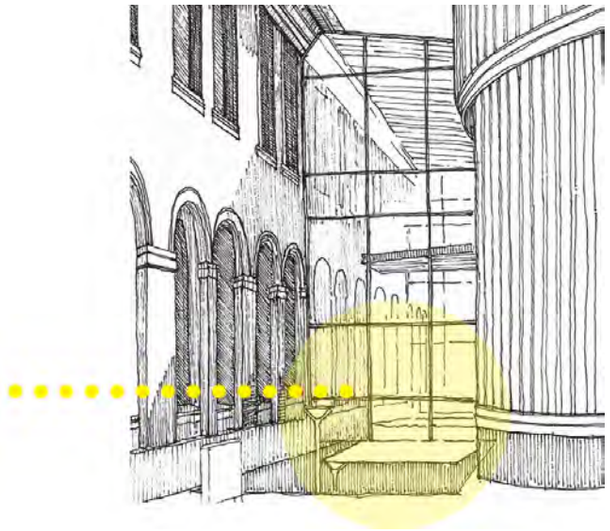


SECOND FLOOR

THE *IN-BETWEEN* SPACE

The space that lies between the two main existing buildings works to unite different elements of this part of the campus. It is in this "in-between" space that chance interactions and engagements can occur; where people from different departments can meet and where these spontaneous encounters can even lead to radical exchanges and entire shifts of knowledge. The ramps, stairs and space for crowds around the canteen provide for this transitional space. The transitional spaces contribute significantly to a sense of place within the building and on this part of the campus as a whole; it is these spaces at the crossing of thresholds where dialogue occurs.

The interface between the south building and the new ramp that hangs in the interstitial space also creates exciting moments. The architect did not continue the ramp between the first and second levels, and in doing so, creates a dramatic space: the uppermost ramp hovers above, leaving ribbed balustrades to snake under tubular steel stringers, and latching onto tensile steel hangers. This element gives the structure a zoological or bacteriological quality (Coetzer, 2007:36).



PLACES OF POWER

The director's and administration's accommodation is placed at the top of the drum form. This prescribes a spatial hierarchy that reinforces notions of control, and can be drawn back to Foucault's ideas presented in "Discipline and Punish" (1986), whereby the panopticon is used as an architectural expression of how space can be designed as a mechanism of observation and dominance. Coetzer (2007: 36) suggests that had the space perhaps been dedicated to the general staff instead, further notions of the institution as a space of power and dominance could have been broken down.

Additionally, even though the glass drum is such a distinct form, it shares tectonic characteristics with the infill space between the two buildings behind it. It appears somewhat like a protrusion from this space, yet in its form as a cylinder on a circular plan, presents itself as a pure entity. In this way, it could be seen as a confusion of the formal clarity of the architect's idea (Coetzer, 2007:36).

TOWARDS A DESIGN METHODOLOGY

The laboratories of the existing buildings that comprise the Institute are austere: without texture or colour. Taking advantage of the quality of light and space created by using glass and steel, as well as the warmth of timber finishes on the interior, Fagan's addition of the Link Building provides a relief to the ascetic world of rationalism and scientific investigation by providing an environment that evokes a sense of invitation and gathering.

The addition is able to absorb informal interaction, and through its design, gives attention to the smaller rituals of daily life – such as the way the stairways have been made wide enough for people to stop for a chat without disrupting the flow of traffic (Deckler et al., 2006: 101). It is a contemporary expression in the setting of institutional historicism, providing for a successful counterpoint and encouraging a discussion thereof.

DEPARTMENT OF BIOCHEMISTRY, BIOTECHNOLOGY AND MICROBIOLOGY, ADDITIONS AND NEW BUILDING.

REINIER BRÖNN ARCHITECTS.

LOCATION: UNIVERSITY OF THE FREE STATE, BLOEMFONTEIN.

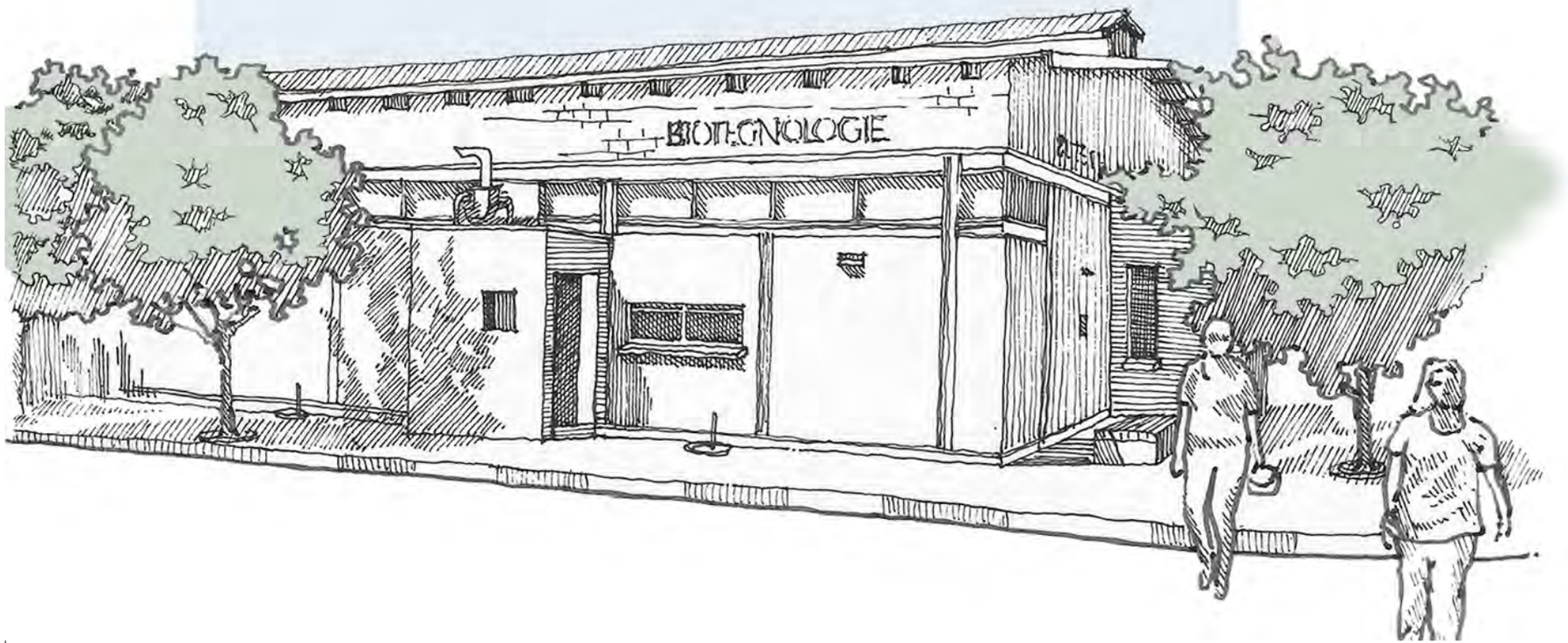
COMPLETED: 2014.

IMAGE (LEFT): Aerial view of the University of the Free State, Bloemfontein. *(Source: Google Maps - https://www.google.co.za/maps/place/University+of+the+Free+State/@-29.135945,26.162099,713 - 28 February 2015).*

CASE STUDY: a **personal experience** of a microbiology laboratory in an academic setting

2.4.2.4. UFS DEPT. OF BIOTECHNOLOGY AND MICROBIOLOGY

The Department of Microbiology, Biochemical and Food Biotechnology at the University of the Free State received new buildings and additions to existing structures, designed by Bloemfontein-based architect, Reinier Brönn. The buildings were completed in phases so that they could be utilised by students of the university as the academic year progressed over their total construction period. The predominant reason this case study was undertaken was to determine an appropriate accommodation list suitable for the requirements of laboratory work of this nature, and conducting research in these fields of interest. Consequently the postgraduate laboratories were studied. The case study was conducted as a form of cognitive, experiential research, and as much as the walk-through assisted in developing the programme from a functional point of view, one of the primary points of interest, personally, was the way that the buildings were experienced by the human beings who utilised them.



GROUND FLOOR PLAN OF POST-GRADUATE MICROBIOLOGY LABORATORIES

LABORATORIES WITH ADJOINED SERVICES

“HOT” SERVICES (INCUBATORS, GROW ROOMS)

“COLD” SERVICES (FREEZERS)

STORAGE

OFFICES FOR STAFF AND RESEARCHERS

FACILITIES FOR STUDENTS (SEMINAR ROOM)

COURTYARDS

CIRCULATION

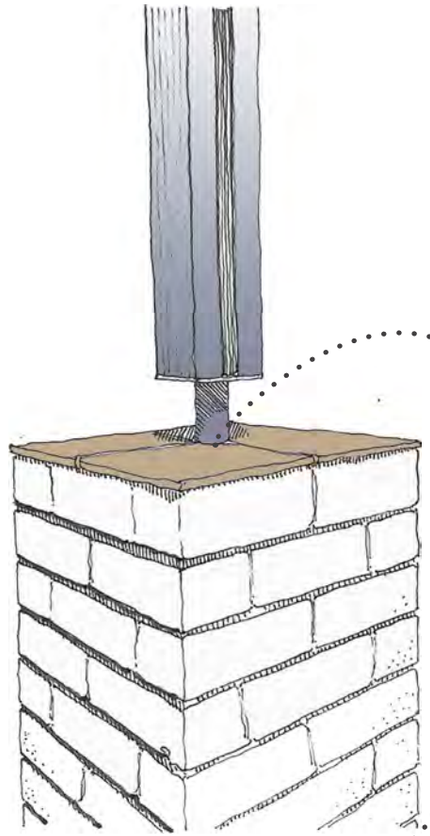
REQUIREMENTS FOR A MICROBIOLOGY LABORATORY DEDUCED FROM THE CASE STUDY:

Laboratories:	75m² x 7 =	525m²
Grow room:	15m² x 1 =	15m²
Small incubators:	6m² x 7 =	42m²
Large incubator:	35m² x 1 =	35m²
Microscope rooms:	13m² x 2 =	26m²
General offices:	15m² x 10 =	150m²
Lab cubicles:	10m² x 5 =	50m²
Yeast-culture collection:	23m² x 1 =	23m²
Crystallography:	25m² x 1 =	25m²
Small cold rooms:	9m² x 2 =	18m²
Large freeze room:	20m² x 1 =	20m²
Radioactive room:	20m² x 1 =	20m²
Dark rooms:	10m² x 2 =	20m²
Courtyards:	150m² x 2 =	300m²
Reception:		15m²
Waiting area:		25m²
Circulation:		390m²
Seminar room:		60m²
Staffroom and kitchen:		95m²
Ablution:		38m²
Storage:		100m²
Deliveries:		10m²
TOTAL:		2 002m²

“HUMANISING THE LABORATORY”

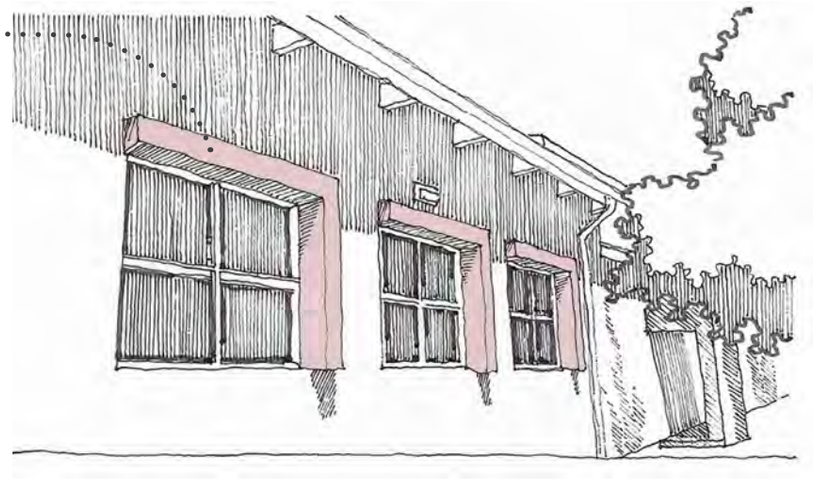
The accommodation list, overall, is divided into different buildings with varying components to meet specific requirements. Because the laboratories are spread out and the mass actually required subdivided into different buildings, the buildings could maintain a predominantly single-storey scale, with small areas of two levels allocated, where required, to offices and administrative functions. Therefore, even though the functional programme requirements of the buildings are extensive, the scale is not overwhelming and remains sensitive to the student culture present on the campus.

The articulation of the shading corners over the windows on the sun-facing elevations is not only a practical consideration, but also emphasises an idea of the frame as a conceptual construct, highlighting certain views both in and out of the laboratories. Furthermore, the bases and tops of the columns present in the courtyards have been articulated and designed to appear more slender. This somewhat challenges conventional ideas of the institution and can be viewed as a means of reinterpreting Classical columns of the Greek orders.

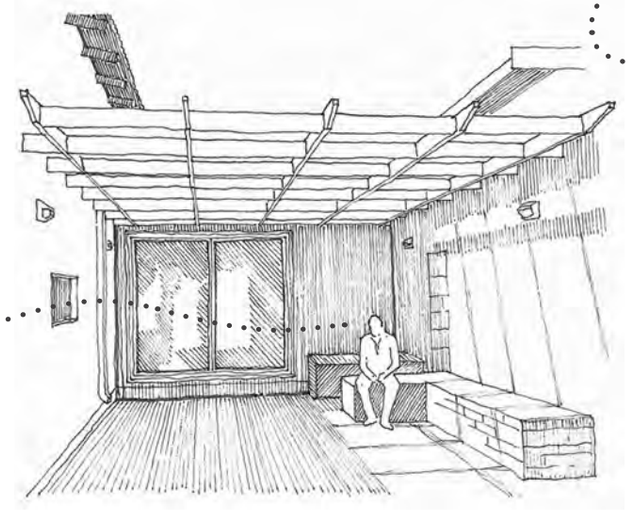


COLUMN ARTICULATION

WINDOW ARTICULATION

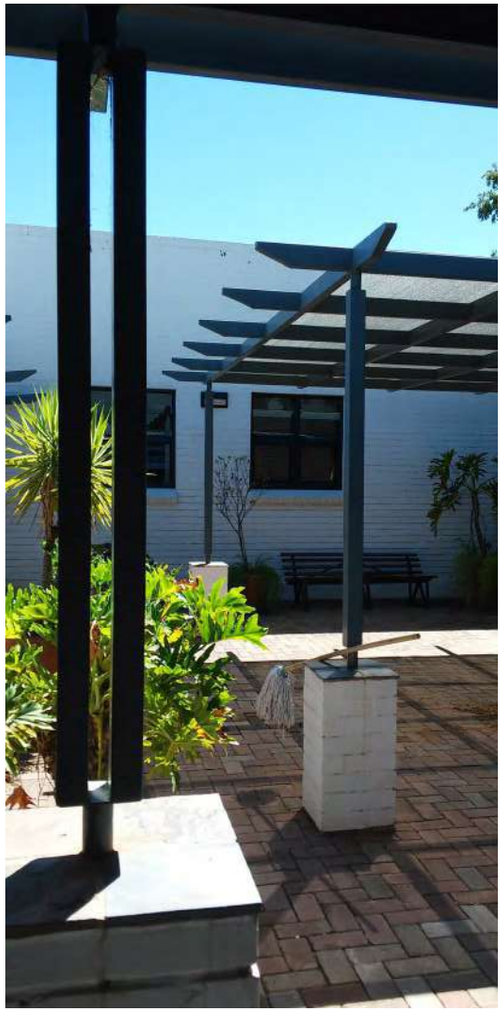


EXTERIOR PLACES FOR GATHERING



The primary means of humanising the laboratory in this case study would be the inclusion of the courtyards between the laboratories, bisected by a circulation channel. The laboratories have been placed along the perimeter of the building mass, with an encircling circulation passage that then connects these spaces to services and storage. The offices for researchers can open onto these central courtyards. In other words, these courtyards become "relief spaces" and spaces of dialogue, and act as antithesis to the austere and sterile environment of the laboratory interiors. These spaces allow for a means of "break away", taking in fresh air, and a reconnection to natural elements. The courtyards have been paved, with shading trellises and a perforated covering overhead that still permits an adequate amount of sunlight to pass through. There is a tree in each courtyard, as well as potted plants and timber benches, all signifying a place of gathering. Therefore these courtyards become the primary spaces of informality, creativity, complexity and interdisciplinary communication; where staff and postgraduate students may gather on an equal social plane of interaction.

THE COURTYARDS AS THE ANTITHESIS TO THE LABORATORY INTERIOR



THE EXTERIOR COURTYARDS AT THE UFS CASE STUDY AS A PLACE OF GATHERING

GREEN SPACES PROVIDE A “BREATHING SPACE” FROM THE LABORATORY INTERIORS

2.4.3. ACCOMMODATION LIST

The following accommodation list is provided as a list of the different functions that are included in the final design proposal. This programme was determined from the requirements of the client, as well as those deemed most important through the study and analysis of similar building types.

GROUND FLOOR

PRIMARY CIRCULATION CORE

Arrival platform:	113,6m^2
Primary reception:	12,5m^2
Waiting area:	16,9m^2
Tea-kitchen:	10,5m^2
Double volume (atrium):	25,2m^2
Elevator shaft:	6,7m^2
Service shaft:	5,9m^2
Enclosed lobby:	27,6m^2
Stairway (on plan):	16,8m^2
Waiting area/lounge:	27,6m^2
Exhibition passage (1):	40,9m^2
TOTAL:	303,6m^2

ADMINISTRATIVE COMPONENT

Female ablution:	16,7m^2
HC ablution:	3,6m^2
Male ablution:	14,8m^2
Change room:	7,2m^2
Maintenance staff kitchen:	21,1m^2
Cleaning store:	13,1m^2
Service alley:	25,4m^2
Passage (1):	44,8m^2
Offices: [13,2m^{2}x5]	66m^2
Courtyard/garden:	121,3m^2
Passage (2):	34,7m^2
Staff room/dining area:	51,1m^2
Boardroom:	35,4m^2
Waiting area:	28,6m^2
Director's office:	20,9m^2
Secretary's office:	12,2m^2
Passage ramp (leading from admin block):	57,2m^2
TOTAL:	574,1m^2

RESEARCH FACILITY

Reading passage:	26,3m^2
Female locker room:	11,2m^2
Male locker room:	11,2m^2
Change room [3,6m^{2}x2]:	7,2m^2
Kitchen:	19,2m^2
Media preparation and weighing room (1):	19,2m^2
Testing laboratory (1):	72,5m^2
Atrium:	26,9m^2
Research laboratory (1&2):	64m^2
Writing room:	19,5m^2
Media preparation (1)	19,2m^2
Reference culture room:	19,2m^2
Service shaft:	9,3m^2
Laboratory waste collection:	11,4m^2
Tested sample store:	25,6m^2
Sample receipt room:	25,6m^2
Technical management and administration:	25,6m^2
Service shaft [2,95m^{2}x2]:	5,9m^2
Male ablution:	14,8m^2
HC ablution:	3,6m^2
Female ablution:	16,7m^2
Service alley:	25,4m^2
Cleaning store (1):	6,7m^2
Cleaning store (2):	4,2m^2
Enclosed lobby:	19,2m^2
Stairway (on plan):	16,8m^2
Circulation passages (total):	173,6m^2
TOTAL:	690m^2

FIRST FLOOR

PRIMARY CIRCULATION CORE

Double volume (atrium):	25,2m²
Elevator shaft:	6,7m²
Service shaft:	5,9m²
Enclosed lobby:	27,6m²
Stairway (on plan):	16,8m²
Waiting area/lounge:	27,6m²
Exhibition and entertainment area:	68,4m²
Epidemic Education Exhibition (interactive):	42,7m²
Roof terrace:	271,4m²
TOTAL:	492,3m²

RESEARCH FACILITY

Research cubicles [8,1m²x3]:	24,3m²
Foyer to seminar room:	45,6m²
Seminar room (1):	52,1m²
Cleaning and furniture store:	13,7m²
Media Preparation and weighing room (2):	19,2m²
Testing laboratory (2):	72,5m²
Research laboratory (3&4):	64m²
Writing room:	19,5m²
Media preparation (1)	19,2m²
Reference culture room:	19,2m²
Freeze room (1):	21,6m²
Purchased media store (1):	13,4m²
Incubation room (1):	21,6m²
Radioactive room [22,6m²x2]:	45,2m²
Male ablution:	14,8m²
HC ablution:	3,6m²
Female ablution:	16,7m²
Cleaning store (3):	6,7m²
Cleaning store (4):	4,2m²
Enclosed lobby:	19,2m²
Stairway (on plan):	16,8m²
Primary circulation passage:	100m²
Conservatory [55m²x2]	110m²
TOTAL:	778,1m²

SECOND FLOOR

PRIMARY CIRCULATION CORE

Double volume (atrium):	25,2m²
Elevator shaft:	6,7m²
Service shaft:	5,9m²
Enclosed lobby:	27,6m²
Stairway (on plan):	16,8m²
Waiting area/lounge:	27,6m²
TOTAL:	109,8m²

RESEARCH FACILITY

Research cubicles [8,1m²x5]	40,5m²
Passage:	25,4m²
Foyer to seminar room:	45,6m²
Seminar room (2):	52,1m²
Cleaning and furniture store:	13,7m²
Event preparation:	13,7m²
Media Preparation and weighing room (3):	19,2m²
Testing laboratory (3):	72,5m²
Research laboratory (5&6):	64m²
Writing room:	19,5m²
Media preparation:	19,2m²
Reference culture room:	19,2m²
Freeze room (1):	21,6m²
Purchased media store (1):	13,4m²
Incubation room (1):	21,6m²
Radioactive room [22,6m²x2]	45,2m²
Male ablution:	14,8m²
HC ablution:	3,6m²
Female ablution:	16,7m²
Cleaning store (3):	6,7m²
Cleaning store (4):	4,2m²
Enclosed lobby:	19,2m²
Stairway (on plan):	16,8m²
Primary circulation passage:	100m²
Conservatory [55m²x2]:	110m²
TOTAL:	798,4m²

SUM TOTAL: 3746,3m²

The design proposal will also include the development of extensive exterior spaces which are not bound by walls, and have therefore not been included in the measured accommodation list. This development will be comprised of a walkway along the north periphery of the site, originating from an ode to the “memory” of the original residential structures. Further exterior developments will include the proposal of community gardens to the south of the primary building, as part of a scheme for future developments.

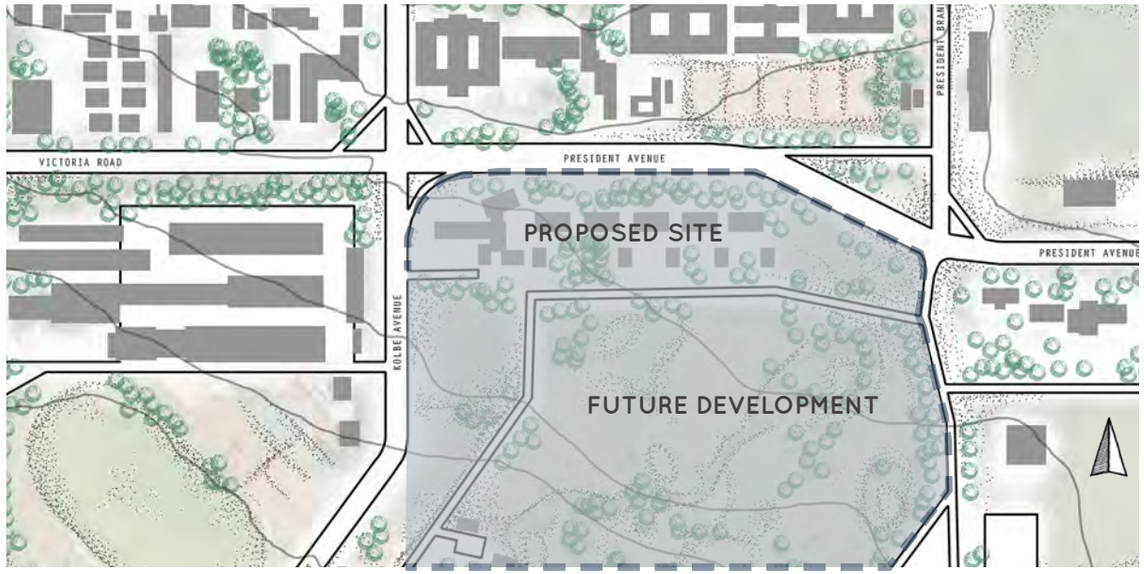
2.5 TOPOLOGY

The proximity of the proposed site between the National Hospital complex to the south, and the Central University of Technology to the north implies that the proposed centre can be utilised by researchers, doctors and students working at the Hospital, as well as postgraduate students who study specific fields of medical technology and conduct research.

In terms of the intended public interface, the site, which is bound by high-velocity vehicular traffic, is also passed by a steady pedestrian network of staff and patients visiting the Hospital, as well as students attending the technology campus. Furthermore, school children of Louis Botha Technical High School to the east also frequently pass the site.

2.5.1. HISTORY OF THE CONTEXT

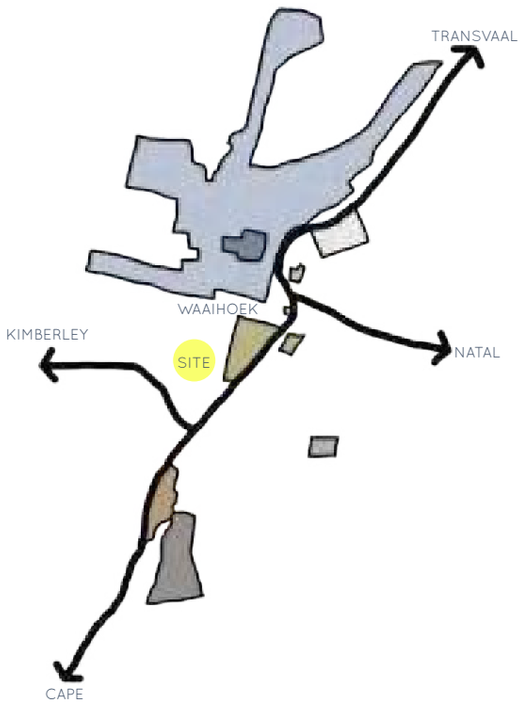
The suburb of Oranjesig, where the site is located, was formerly considered a fringe area, which has been going through a process of desegregation and transition. Part of the suburb, to the northeast, is in close proximity to the historical district previously known as Waaihoek. Oranjesig was formerly characterised as a low-income white suburb and served as a buffer zone between Bloemfontein and the newly enforced black suburbs its east, in terms of the apartheid model city (Impuls Centrum, 2000: online). Today the suburb consists primarily of the Free State Psychiatric Complex and residences.



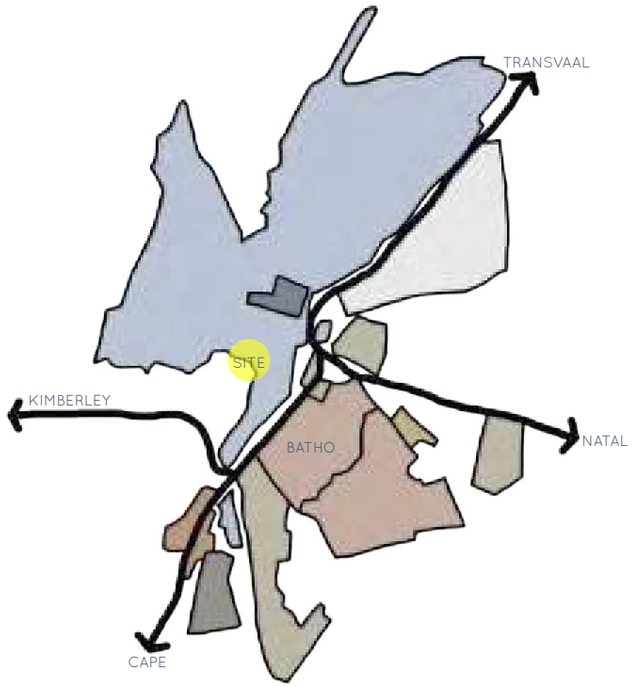
THE TRANSFORMATION OF BLOEMFONTEIN FROM 1910 TO 1986:

EDITED FROM: https://www.impulscentrum.be/south_africa/Mod3_city/maps/

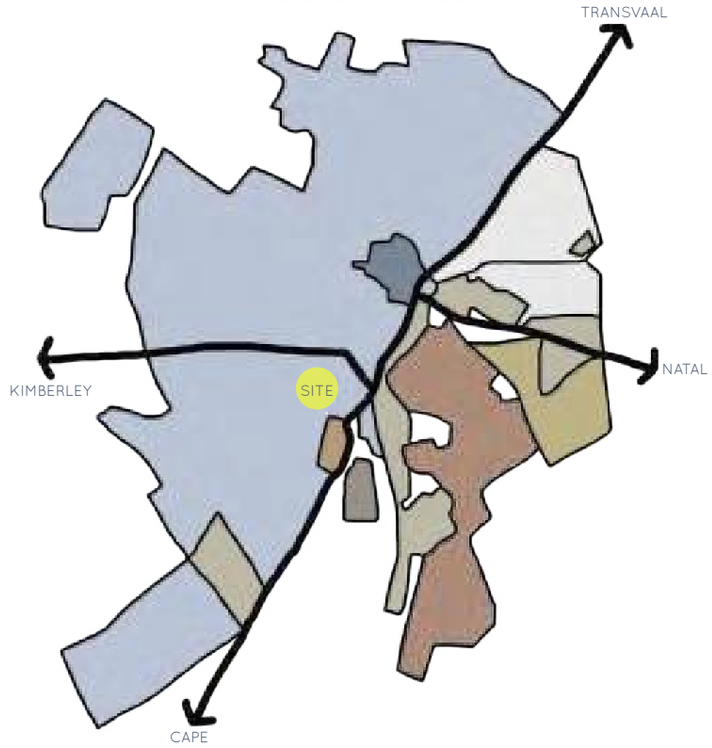
COLONIAL CITY - 1910



SEGREGATED CITY - 1950



APARTHEID CITY - 1986



WHITE RESIDENTIAL

BLACK RESIDENTIAL

COLOURED RESIDENTIAL

CBD

INDUSTRIAL AREAS

TRANSPORT

RIFLE RANGE

CEMETERY

THE FREE STATE PSYCHIATRIC COMPLEX

The Free State Psychiatric Complex was the first institution established to treat people with psychiatric disorders in South Africa north of the Orange River. It was founded in 1883 as an "asylum" and it experienced steady growth from 10 patients initially to 112 in1904. During this period, the adjacent sites were acquired, and "native quarters" and a wing for women were added. Patients with psychiatric disorders were conveyed to Bloemfontein from various parts of the country to be housed at the expense of the state in this government-run building (Burrows, 1958: 292).

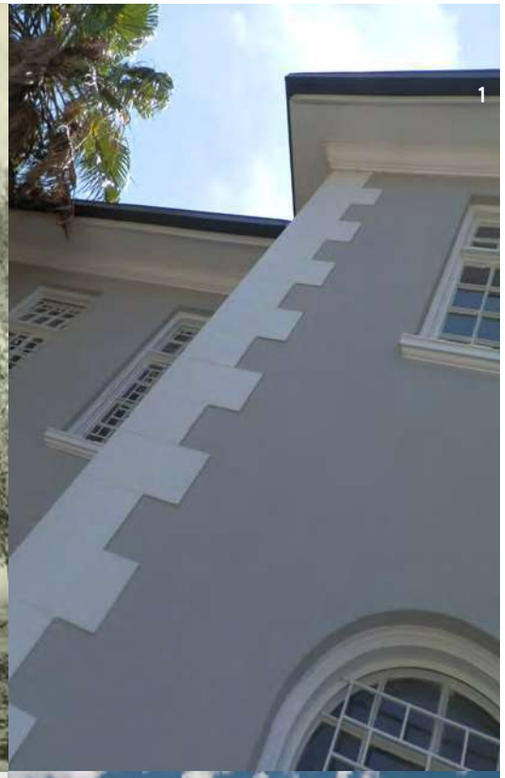
The institution took to a new approach of treating people with psychiatric disorders when it established its own orchard and garden as a means of therapy for the patients. By 1897, it had become the largest medical institution in the former Republic of the Orange Free State. The complex is interesting as it illustrates the development of the architectural language of the Department of Public Works (DPW) in South Africa over an entire century (Burrows, 1958: 292).

The chief design architect for the DPW during the construction of the mental hospital was John S. Cleland, who was influenced by the likes of Herbert Baker and Gordon Leith. Cleland's art-deco inspirations drew from the South African zeitgeist at the time, which sought to express the power of the Union and define an appropriate "South African style" (Burrows, 1958: 293). However, as campuses were added over time, they became somewhat isolated from one another, presenting the complex as incongruous rather than institutionally unified.

In 1986 the treatment of patients became more "scientific", and treatment was focused on two components, namely a psychiatric division, and a component dedicated to the care and rehabilitation of people with intellectual disabilities. In 2003, the complex's name was officially changed from Oranje Hospital to its current name, Free State Psychiatric Complex, and it now houses over 850 patients (Burrows, 1958: 293).

IMAGE: The main building of the Free State Psychiatric Complex as it looks today. *(Source: http://artefacts.co.za - accessed 5 February 2015).*

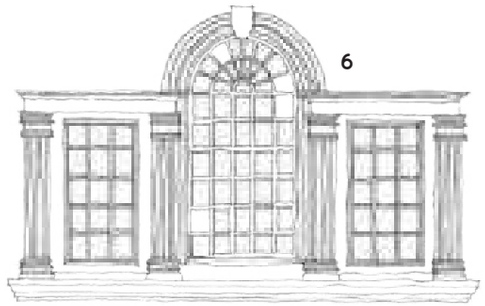
IMAGES (TOP): A historic image of the main building of the Psychiatric Complex (Oranje Hospital) taken soon after its construction in 1883. *(Source: http://taljaard.blogspot.co.za/2005/11/oranje-hospitaal-bloemfontein-remember.html - accessed 5 February 2015).*

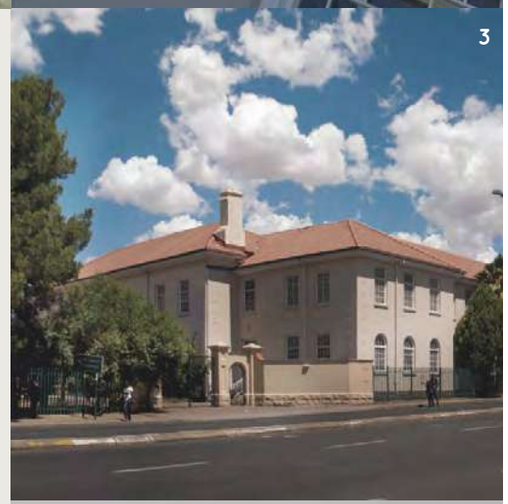


CENTRAL UNIVERSITY OF TECHNOLOGY'S SCHOOL OF ART AND DESIGN

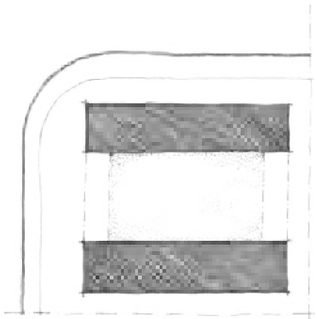
This building is situated directly adjacent to the proposed site, and it also emphasises classical notions of institutional architecture. It is not so much the history of this site that has a bearing on the design of the proposed project, but rather the architectural language that emerged from it. When Eunice Girls' School was founded in 1875, the school was built on various parts of the Central University of Technology's campus. In 1928, Eunice Primary was built as the building now used by the School of Art and Design which reflected a neoclassical style with references to Palladian architecture.

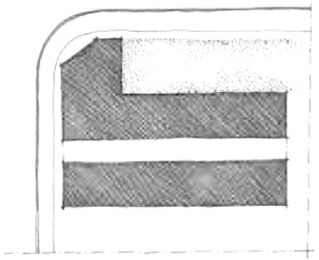
This reference can be seen in the use of Palladian windows on the street-facing elevations. This type of window consists of a central light with a semicircular arch over it, carried on an impost of a small entablature under which are pilasters that enclose two other lights on either side. This neoclassical design approach evokes rationality and a striving towards clarity and order through the investigation of proportions considered harmonic (Curl, 2003: 222). The building itself is symmetrical, with little to no climatic considerations and flat elevations, but it does include courtyards, which are a prominent feature of the buildings of this semi-institutional, semi-residential context.

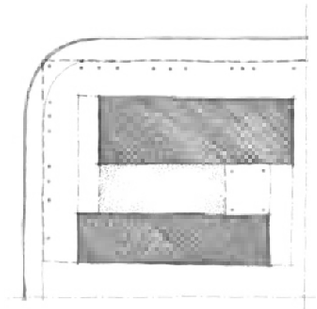


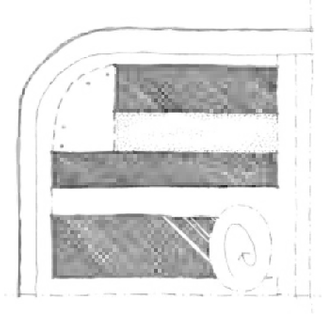


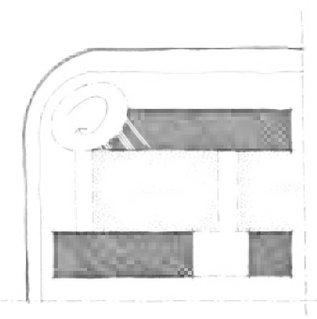
IMAGES:
1-4. Photographs of the CUT's School of Art and Design as it presently (2015). It is a monolithic structure with a strong neoclassical character.
5. The building was first constructed as a school (Eunice Girls' School).
6. A typical Palladian window, expressing principles of symmetry and harmonic proportions, which influenced the design of the building.

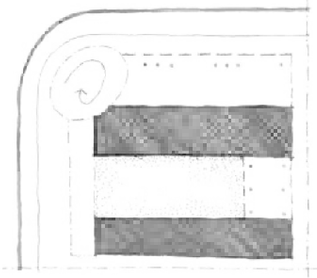


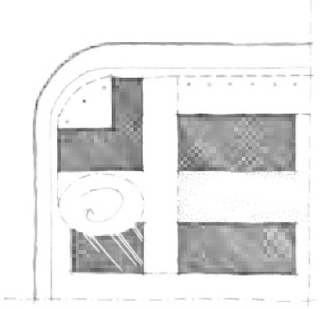


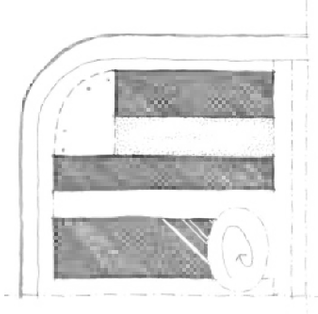












2.5.2. THE CORNER PREDICAMENT

The site is essentially located on a corner; posing both challenges and more exciting opportunities. A corner site such as this one, rather open and not immediately surrounded by other buildings, implies that the proposed building will need to communicate more than one approach visually. In other words, the proposed building will not have a "back facade" where all services can be gathered and hidden away from public view. This implies a design methodology that leans towards a traditional distinction between "served spaces" and "service spaces". The north and western sides of the site are flanked by high-velocity roadways that bisect the city of Bloemfontein. Therefore, the site experiences extensive vehicular traffic and the noise that goes with it. This "corner-aspect", so to speak, is influential on the transition from public to private space and the way the gradation of space can be facilitated to handle these facets of the context successfully. As far as vehicular traffic impacts the site, it is a site that also experiences steady pedestrian movement along its boundaries: school children pass the site on their way to and from Louis Botha Technical High School to the west, while students and staff pass on the sidewalks of the north-south bisection between the Central University of Technology (north) and the National Hospital (south). However, the sidewalks are not well maintained and do not necessarily facilitate an ease of access for the mass of pedestrians that in fact activate the site.

IMAGES (LEFT AND RIGHT):
The corner was perceived as an open site that needed to be reclaimed by the public. Nonetheless, it was challenging to find a way of approaching the corner without creating an "object" out of the building. Furthermore, the design approach had to seek a balance between providing the required functions (the built form) as well as adequate public space.

These same opportunities that can facilitate public interaction can, however, lead to architectural expressions of an “object building”. As much as the building needs to invoke public interest and definitely consider visual, aesthetic principles in its design approach, it still needs to relate to its context. Because the aims of the project are grounded in a certain sensibility to the requirements of the site, the experiential and measured phenomenology of the site become important when exploring a design methodology. The proposed site lies within a typically institutional context: the grounds of the psychiatric complex on which it is located, with additional sports facilities for the purpose of grounds-keeping, and the campus of the Central University of Technology to its north. There is also a predominant residential aspect to the context, and a defined modernist influence, especially seen in the Villa Verona residential apartments on the northwest corner adjacent to the site. The corner offers an opportunity to find a way to reflect and reveal these different aspects.

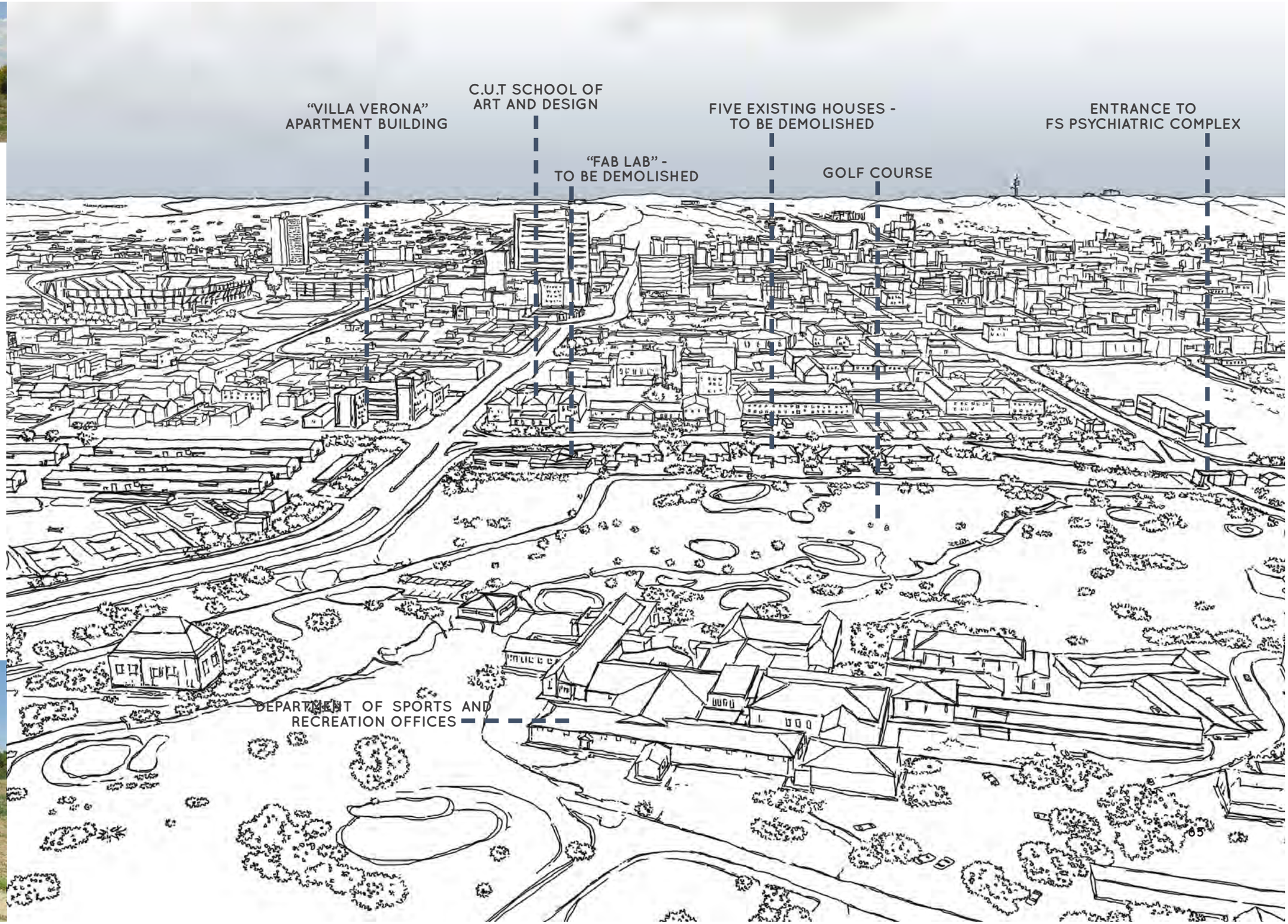
IMAGE (BELOW): The building currently located on the corner of this site is a component of the Central University of Technology, that specialises in laser-cutting materials. This building, complete with a fence around it, can be relocated to the CUT campus, so that the corner can be reclaimed and given back to the public, and pedestrian especially, considering the high velocity vehicular traffic surrounds the site.

2.5.3. WASTED SPACE

Golf courses require an extensive amount of maintenance in terms of human labour, landscaping and water. During a global crisis concerning food and water shortages, the physical space of a golf course can be better utilised to contribute to a better lifestyle and as a means of opportunity for social interaction by the creation of community spaces. As the economic climate has frequently fluctuated and has settled, by international consensus, into recession, golf courses have suffered neglect and have become symbols of an unsustainable lifestyle.

In this case, especially, where the golf course is found within an urban setting, the space that it consumes can be used to provide for an element of place-making that is missing within this environment. Because the site is located within a context that experiences much of the "in-between" – unable to find a specific architectural identity, situated between territories and areas of different socio-cultural considerations, and neighbourhoods of different economic standing – there is a lack of community within a public realm. The golf course can be repurposed as an aspect that uplifts the community by uniting seemingly disparate individuals. Because disease control, on the personal level of the individual immune-system, is influenced by proper nutritional food intake and access to a clean, fresh environment, the golf course can be repurposed to provide this service, namely vegetable gardens that make nutritional food available, to the area in a manner that initiates public interaction and a sense of community.

IMAGES (ABOVE AND BELOW): Neglected space along the golf course. These photographs were taken early in 2015.


"VILLA VERONA"
APARTMENT BUILDING
C.U.T SCHOOL OF
ART AND DESIGN
"FAB LAB" -
TO BE DEMOLISHED
FIVE EXISTING HOUSES -
TO BE DEMOLISHED
GOLF COURSE
ENTRANCE TO
FS PSYCHIATRIC COMPLEX
DEPARTMENT OF SPORTS AND
RECREATION OFFICES

2.5.4. QUANTITATIVE SITE ANALYSIS

MAJOR HIGHWAYS

MICROBIOLOGY AND BIOCHEMISTRY

MAJOR CITIES

DISEASE CONTROL SOUTH AFRICA CC

NICD

NHLS

The location of an Institute for Disease Awareness in Bloemfontein presents the opportunity for the NICD and NHLS to function on a more centralised basis. The proposed location can allow certain services to reach broader areas of the country.

MACRO

SOUTH AFRICA

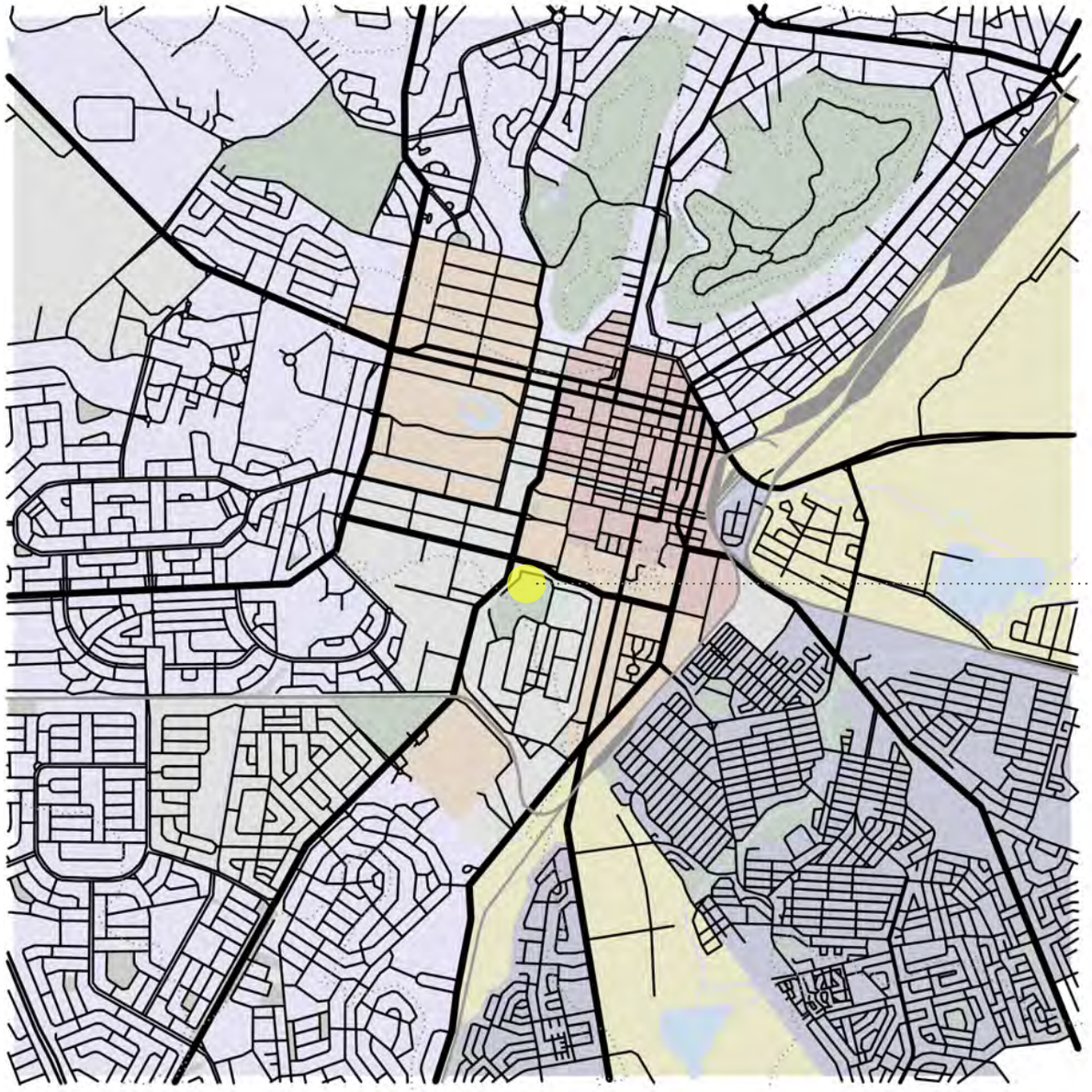
MICROBIOLOGY AND BIOCHEMISTRY FACILITIES IN PROXIMITY TO THE PROPOSED SITE

BLOEMFONTEIN BORDER
N1 HIGHWAY: WESTERN BYPASS
SECONDARY HIGHWAYS
MAJOR CONNECTIVE ROADWAYS
INCLUSION OF MANGAUNG
PROPOSED SITE

The specific location for the project was selected so that the new Institute for Disease Awareness could serve Bloemfontein as well as the broader Mangaung area.

MACRO

BLOEMFONTEIN
WITHIN SOUTH AFRICA



RAILWAYS
INDUSTRIAL
CENTRAL BUSINESS DISTRICT
COMMERCIAL / BUSINESS
INSTITUTIONAL
DENSE RESIDENTIAL
SUBURBIA
PREDOMINANT GREEN AREAS
WATER BODIES

SITE

The site is located on the periphery of a golf course in the midst of institutional, commercial and residential zones.

MACRO

BLOEMFONTEIN

LAND USE IN AND AROUND THE CITY

RAILWAYS CONNECTING BLOEMFONTEIN TO JOHANNESBURG, CAPE TOWN AND OTHER MAJOR CITIES

N8 HIGHWAY CONNECTING THE CITY TO THE EAST AND WEST

WALTER SISULU AVE. TO CONNECT THE N1 AND N8 HIGHWAY

FORT HARE RD. TO CONNECT THE TOWNSHIPS TO MAJOR HIGHWAYS

HARVEY RD. TO CONNECT TO THE N1 HIGHWAY

VICTORIA RD. INTO PRESIDENT AVE. TO CONNECT HARVEY RD. AND PARFITT AVE.

PRES. BOSHOFF ST. INTO KOLBE AVE. TO CONNECT TO THE N1

PROPOSED SITE

MACRO

BLOEMFONTEIN

MAJOR TRANSPORT ROUTES

RAILWAYS

TERTIARY INSTITUTIONS

PRIMARY/SECONDARY SCHOOLS

HOSPITALS

PROPOSED SITE

UFS: UNIVERSITY OF THE FREE STATE

CUT: CENTRAL UNIVERSITY OF TECHNOLOGY

The locational proximity of the proposed site to healthcare and educational institutions is important in terms of the function of the project. The users of both of these types of institutions are intended to interact with the proposed project.

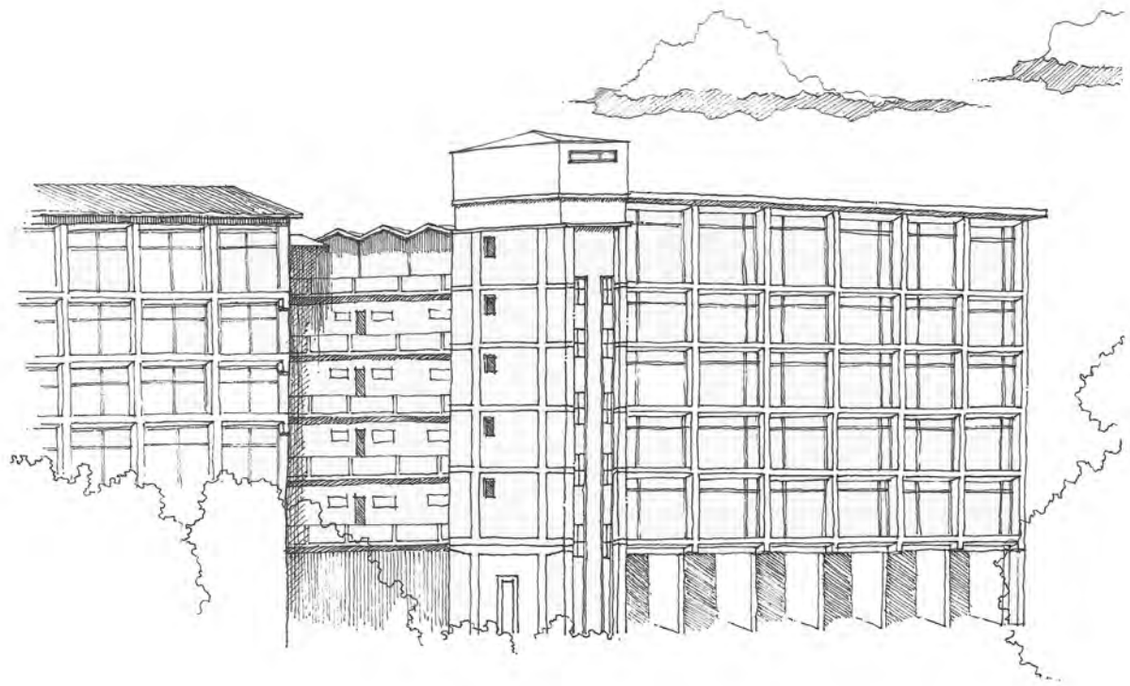
MACRO

BLOEMFONTEIN

TOWN LAYOUT:
SCHOOLS AND HOSPITALS

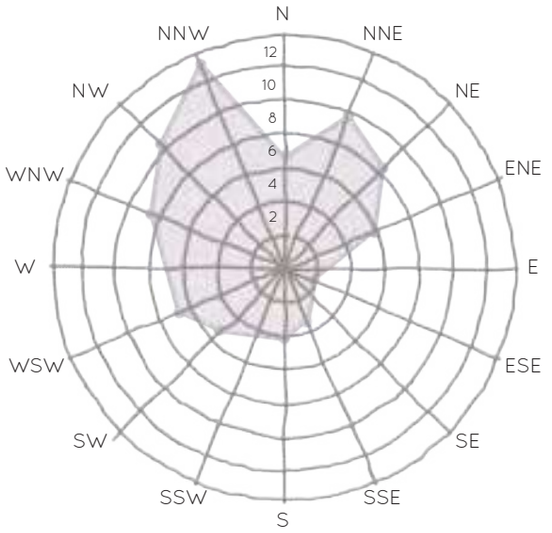
Samples from local hospitals and healthcare facilities can be sent to the proposed Institute for testing and referencing.

NATIONAL HOSPITAL



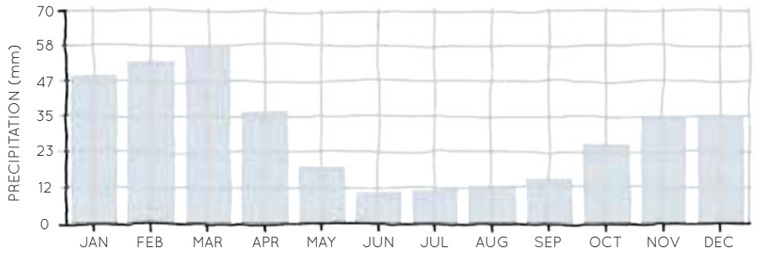
In conjunction with the healthcare facilities and other institutional buildings, the site is also surrounded by residential apartment buildings such as “Villa Verona” (above).

QUANTITATIVE CLIMATIC DATA



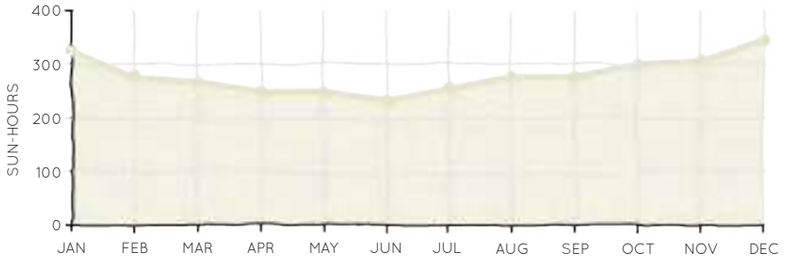
PREDOMINANT WIND DIRECTION IN BLOEMFONTEIN

(Source: www.weather-and-climate.com - accessed 27 January 2015)



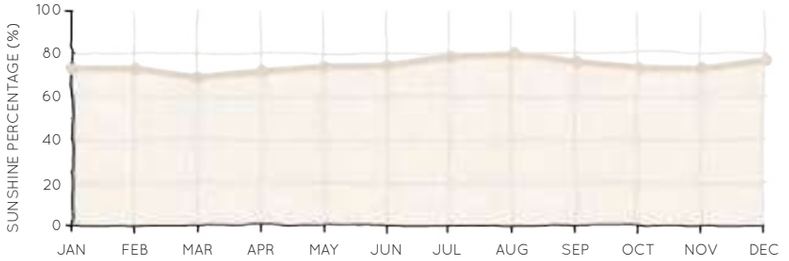
MONTHLY PRECIPITATION OVER A YEAR IN BLOEMFONTEIN

(Source: www.weather-and-climate.com - accessed 27 January 2015)



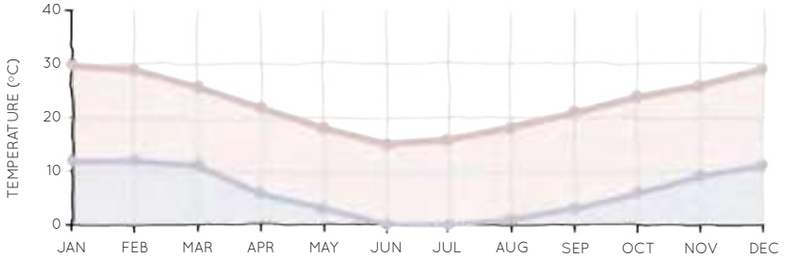
MONTHLY TOTAL OF SUN-HOURS

(Source: www.weather-and-climate.com - accessed 27 January 2015)



AVERAGE PERCENTAGE OF DAILY SUNSHINE

(Source: www.weather-and-climate.com - accessed 27 January 2015)

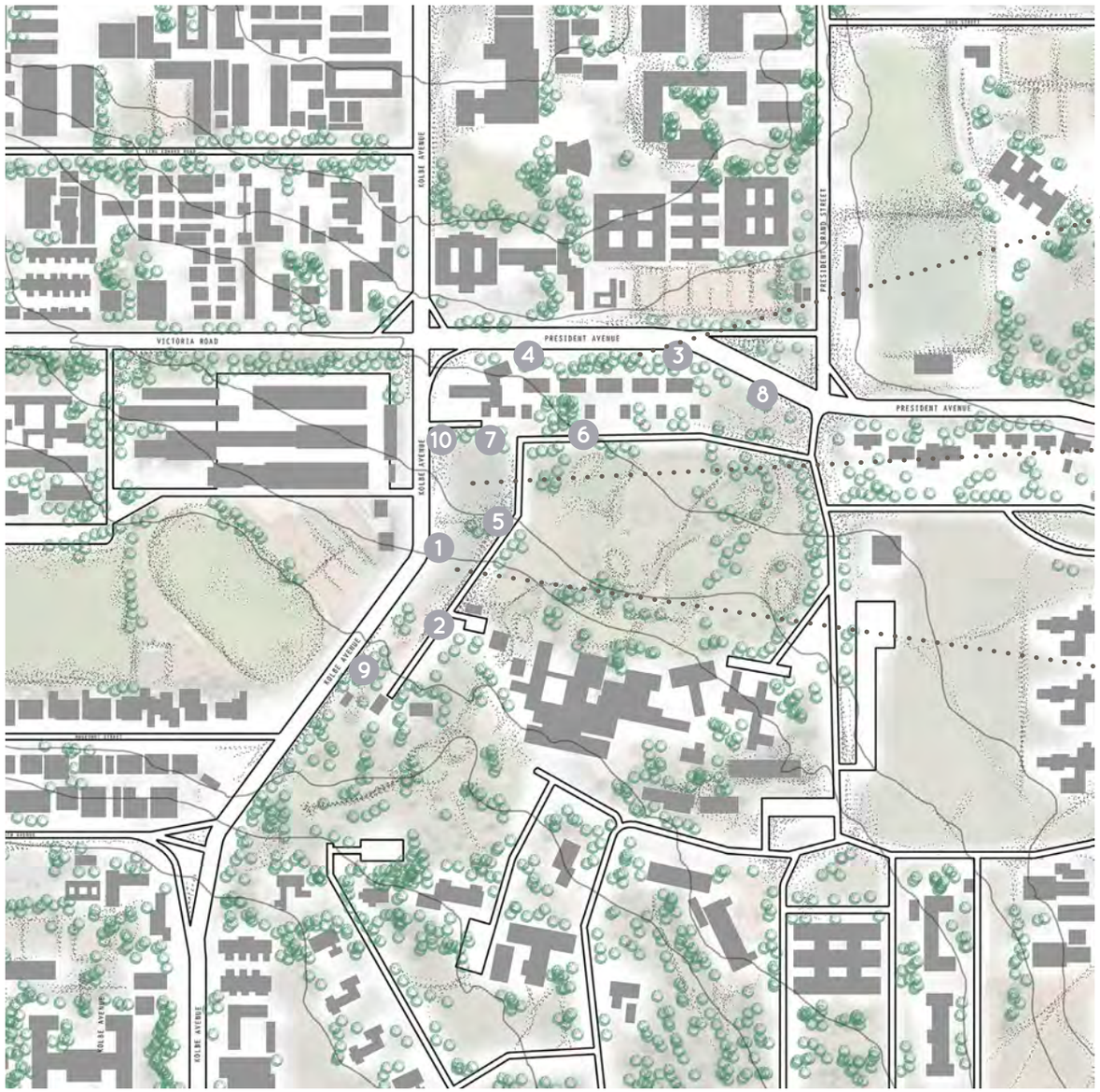


AVERAGE MONTHLY TEMPERATURES

(Source: www.weather-and-climate.com - accessed 27 January 2015)

CADASTRAL INFORMATION

2.5.5. QUALITATIVE SITE ANALYSIS



MESO

FS PSYCHIATRIC COMPLEX

THE EXPERIENCE OF FAUNA AND FLORA IN A PERI-URBAN SETTING


1


2


3


10


4

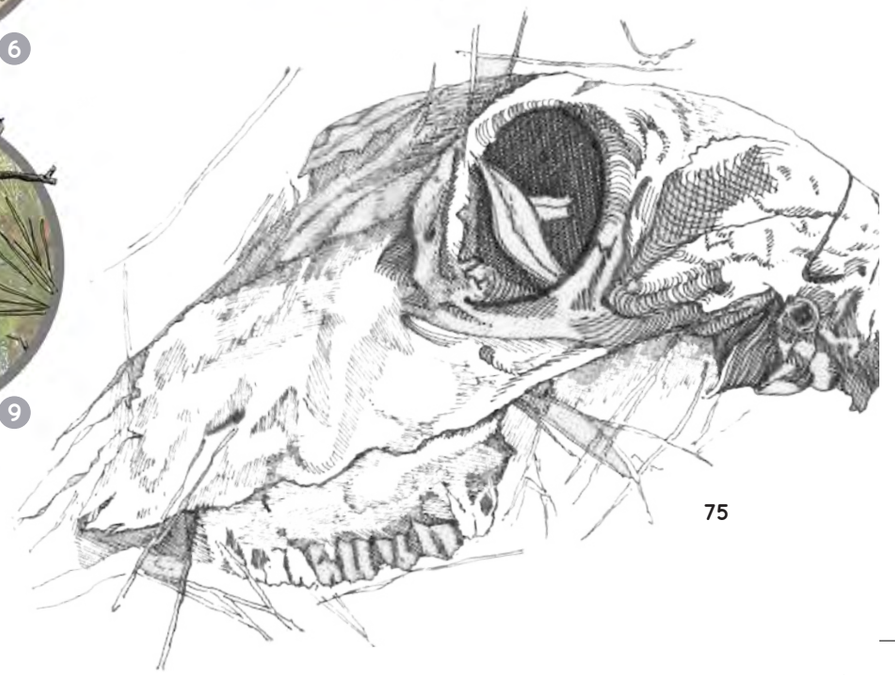

5


6


7


8


9



PRIMARY SITE ACCESS

SECONDARY SITE ACCESS

TRAFFIC MOVING NORTH

TRAFFIC MOVING SOUTH

TRAFFIC MOVING EAST

TRAFFIC MOVING WEST

The site is bound by high-velocity vehicular traffic, generating a noisy environment.

MICRO

C/O PRES. AND KOLBE AVE.

VEHICULAR MOVEMENT PATTERNS

PRIMARY PEDESTRIAN MOVEMENT OCCURS BETWEEN THE CUT AND NATIONAL HOSPITAL (SOUTH).

PEDESTRIAN MOVEMENT ALSO OCCURS FROM THE CBD INTO MORE RESIDENTIAL AREAS.

BUSY TRAFFIC INTERSECTION

Even though sidewalks around the proposed site are frequented by many pedestrians, many of them, especially those towards national hospital to the south are not well- equipped to handle foot traffic. There is a lack of proper paving to cater for pedestrians along this primary route.

MICRO

C/O PRES. AND KOLBE AVE.

PEDESTRIAN MOVEMENT PATTERNS

PHYSICAL BOUNDARIES (FENCES)

PERCEIVED BOUNDARIES

PUBLIC SPACE (SIDEWALKS)

SEMI-PUBLIC

PRIVATE INSTITUTIONS AND RESIDENCES

THE CORNER PRESENTS AN OPPORTUNITY TO CREATE A PLACE OF PUBLIC GATHERING AND INTERACTION.

The context is fenced off for security purposes, which disallows for proper public interaction (as it is), creating a design challenge. Vegetation and clumps of trees create perceived boundaries around the site.

MICRO

C/O PRES. AND KOLBE AVE.

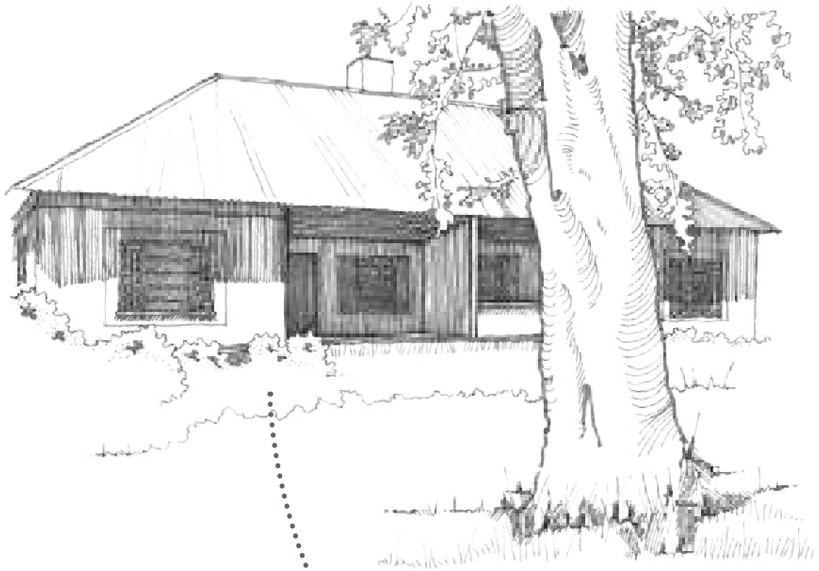
PERCEIVED THRESHOLDS

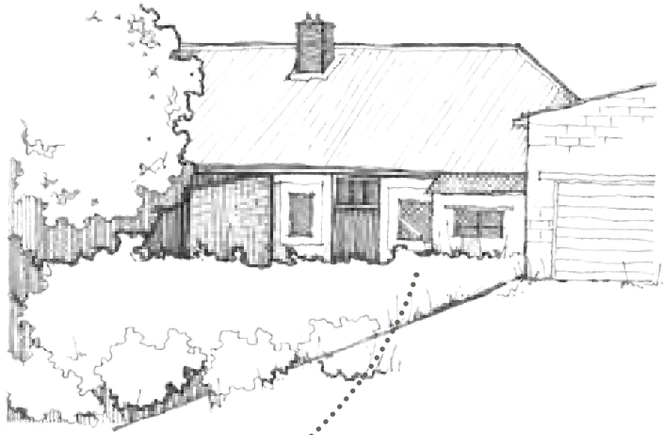
Because of the expansive avenues in the area, the streets are well-lined with trees of varying sizes. Nonetheless, because of the amount of fences, pedestrians are not able to walk under these canopies.

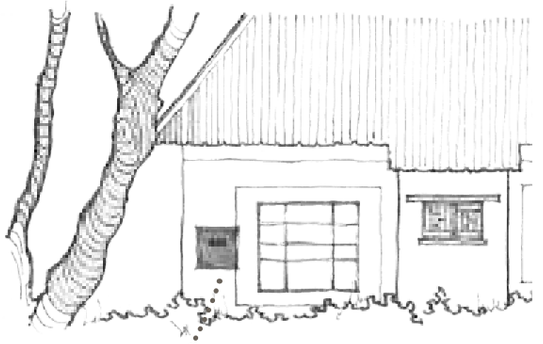
MICRO

C/O PRES. AND KOLBE AVE.

PERCEIVED THRESHOLDS CREATED BY TREES AND FOLIAGE

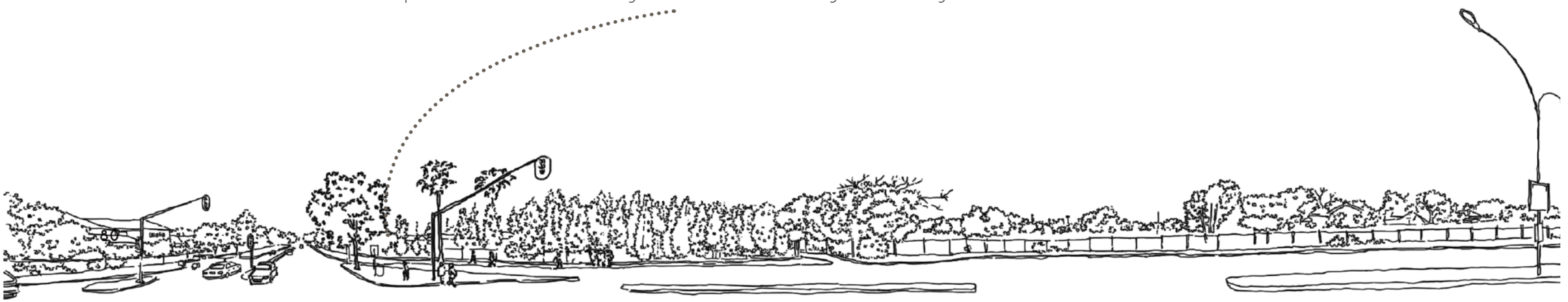




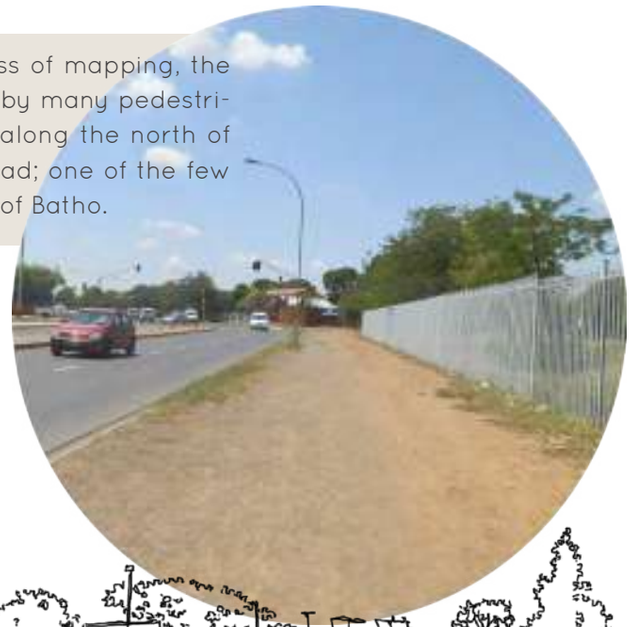


On the northern periphery of the site, overgrown by long grass and wild shrubbery, five unused residences can be found. These small buildings, comprised of clay-brick masonry, which are not at all in disrepair, yet completely unoccupied, create an eerie atmosphere. There is something about them that makes one feel both comfortable and uncomfortable at the same time.

These houses are located on the north-end of the golf-course, along the street facing periphery. They are enclosed by fencing and foliage. The drawing below depicts a site section cutting north to south looking east through Kolbe Avenue.



As indicated through the process of mapping, the sidewalks, although frequented by many pedestrians, are in disrepair. The route along the north of the site extends to Fort Hare Road; one of the few access points into the township of Batho.



THE OASIS CREATED BY THE WATER
COLLECTED IN THE DITCH FORMED ON
THE SITE GENERATES A MICRO-CLIMATE

TEXTURES
DISCOVERED ON SITE
AND WITHIN THE
IMMEDIATE CONTEXT

2.6 MORPHOLOGY

2.6.1. IDENTIFYING A UNIQUE APPROACH

In order to determine a unique approach to the project, the conceptual framework was used as a reference point from which ideas could be investigated. These concepts germinated as associated interests, which were then explored and grounded in research and existing literature. A Precedent studies involving examples that communicate similar morphological aims to the proposed project were researched in order to understand how conventional approaches could be challenged.

2.6.2. PRODUCTIVE REPUBLIC, HANGBERG, CAPE TOWN (2012)

Precedent study: a new morphological application of the scientific institute.

Neoro Architects, alongside six other international practices, were invited to participate in an exhibition hosted by the MAXXI National Museum of the 21st Century Arts in Rome, Italy. Essentially, they were challenged to respond to the themes of energy, architecture and landscape. The idea was not to document existing projects, but rather to commission research with a spatial outcome. Because of the rather dire state of energy generation and its balance with energy consumption, Neoro Architects' research investigates the possibility of energy self-sufficiency and the related spatial implications within an existing settlement (Neoro, 2013: 16).

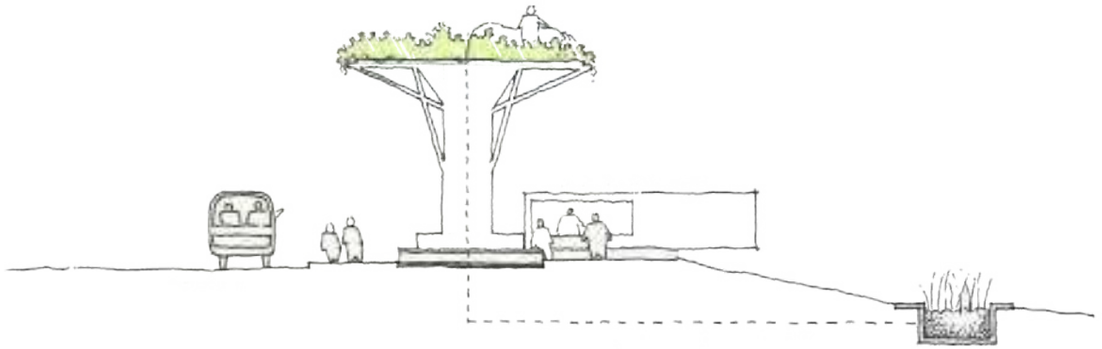


EXHIBIT FOR *'ENERGY: OIL AND POST-OIL ARCHITECTURE AND DRIDS'*, MAXXI MUSEUM, ROME.

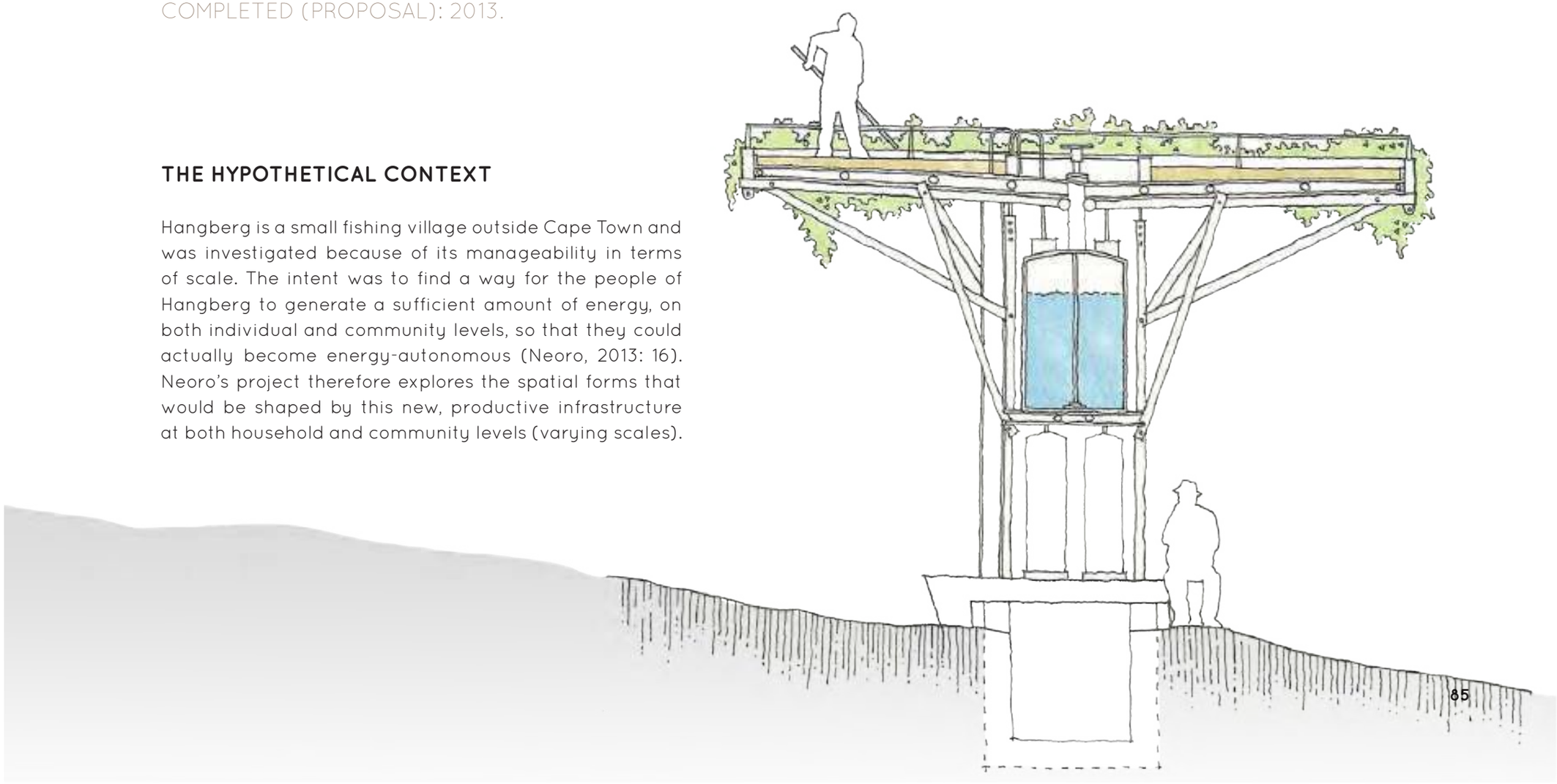
NEORO ARCHITECTS.

LOCATION: (HYPOTHETIC) HANGBERG VILLAGE, CAPE TOWN.

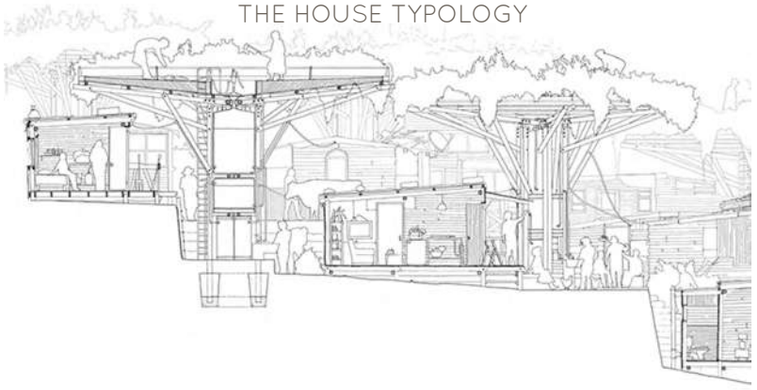
COMPLETED (PROPOSAL): 2013.

THE HYPOTHETICAL CONTEXT

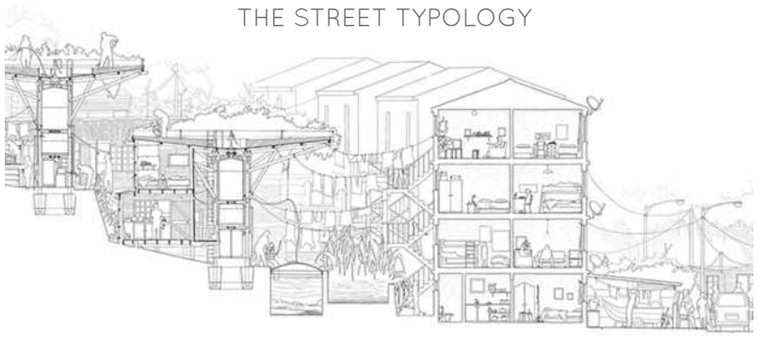
Hangberg is a small fishing village outside Cape Town and was investigated because of its manageability in terms of scale. The intent was to find a way for the people of Hangberg to generate a sufficient amount of energy, on both individual and community levels, so that they could actually become energy-autonomous (Neoro, 2013: 16). Neoro's project therefore explores the spatial forms that would be shaped by this new, productive infrastructure at both household and community levels (varying scales).



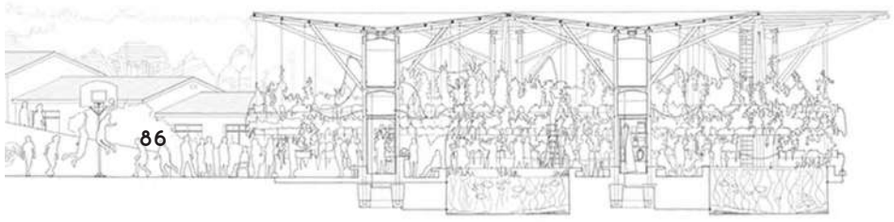
THE HOUSE TYPOLOGY



THE STREET TYPOLOGY



THE PUBLIC SPACE TYPOLOGY



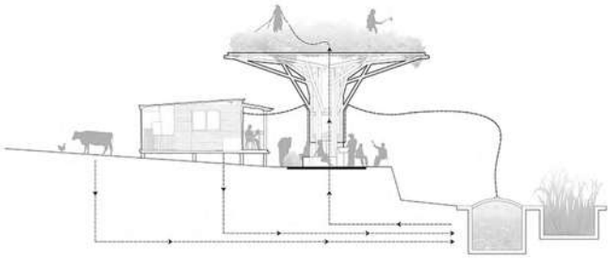
DESIGN OUTCOME

The resultant design can, in its essence, be defined as a tree-like energy machine. Not only are informal settlements upgraded through these "machines", but a small structural footprint also means that they are functionally useful without disturbing that which occurs at ground level. The "tree-machine" utilises biogas production to establish an energy network between houses, and also creates a new horizontal realm that involves harvesting water and collecting food. Therefore, Neoro Architects proposes that, rather than simply planting the small Cape village full of trees, these devices could operate as tree-facsimiles, and operate as a means of creating energy and providing opportunities. Furthermore, these "machines" generate interesting new and tectonic spatial realms (Neoro, 2013: 17).

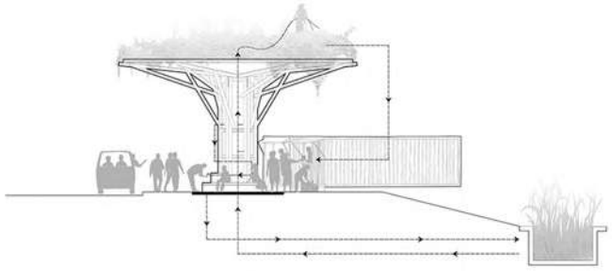
TOWARDS A DESIGN METHODOLOGY

In terms of relevance to the project proposed in this dissertation, the contexts of the two applications are entirely different. Nonetheless, the other precedents analysed thus far, which concern the primary functions and functioning of laboratory and research-based buildings, are not all easily conveyed as "buildings for people", even though society is so fundamentally dependent on disease control and prevention. Therefore, because a public-interface aspect involving fresh produce is included in the accommodation of this dissertation's proposal, Neoro's example sets itself forth as a means of bringing a tectonic as well as community-based aspect to spaces that otherwise simply place a scientific researcher in a box. It is understood that this example cannot merely be replicated on the proposed site in Bloemfontein, but elements could be brought to the context in a manner that is suitable and that engenders interest.

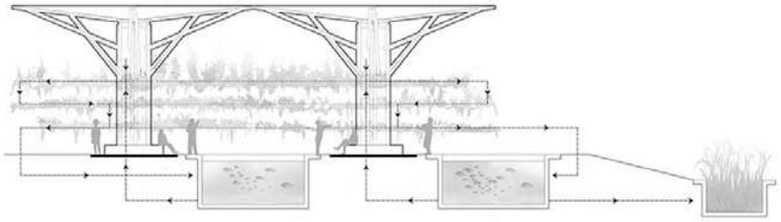
IMAGES (LEFT): The tree-like machines were designed to be suited to the different typologies that would occur within Hangberg. *(Source: http://www.noeroarchitects.com/oil-and-post-oil-architecture-and-grids-project/ - accessed 16 April 2015).*



THE HOUSE TYPOLOGY



THE HOUSE TYPOLOGY



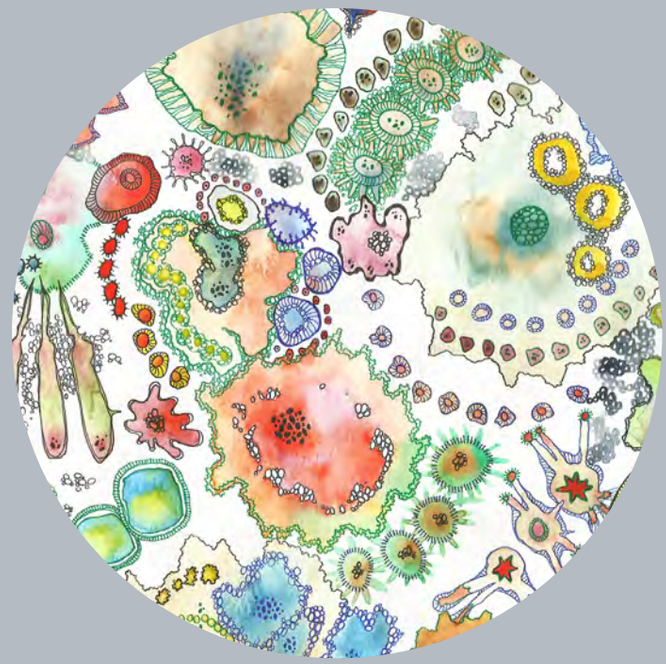
THE HOUSE TYPOLOGY

HANGBERG, CAPE TOWN

ARCHITECTURE AS A TOOL FOR CHANGE

IMAGES (THIS PAGE): The proposal is intended to uplift the community by providing an opportunity for self-sufficiency, and spark long-term change that is broadly beneficial and sustainable. *(Source: http://www.noeroarchitects.com/oil-and-post-oil-architecture-and-grids-project/ - accessed 16 April 2015).*

2.6.3.



DISCOURSE: GROUNDING A UNIQUE APPROACH TO LABORATORY DESIGN THROUGH LITERARY EXPLORATION

SUMMATION OF DISCOURSE

1 Microbiology laboratories as a **mystery**

i. Introducing the notion of **science as a secret**.
ii. Contemporary scientific practices are **veiled** in mystery.
iii. The **scientific researcher** can be seen as the **modern-day alchemist**.

LINK: contemporary science and ancient alchemy

2 **Scientific mysticism:** alchemy as a basis for misconception

i. A brief history and explanation of **alchemy**.
ii. Comprehending alchemy as a practice focused on both **science and philosophy**.
iii. How misconceptions were formed about the **alchemist as a sorcerer**.
iv. Alchemy as the **precursor for scientific fields** of chemistry, physics and biology.

LINK: ancient alchemy and the intentions of architecture

LINK: how scientific reason revealed the "un-secret"

3 **Architecture as 'true alchemy':** a balance of amalgamation

i. Architecture is also a field intrinsically focused on both science and philosophy.
ii. Johnston (1988) – **architecture as an alchemic amalgamation** of historic cultures.
iii. Architecture should be focused around the successful combination of technology, philosophy, and a 'spirit of place'; a **reaction between these three domains**.

LINK: architecture and a notion of the uncanny

5 ***Das Unheimliche*** as the "opposite of what is familiar"

i. "Un-secret" = *unheimlich*: paradoxes, inequalities, uneasiness, indecision = **tension and a lack of balance.**
ii. Cognitive dissonance: **psychological tension** created by the peculiar feeling of something being a mixture between the familiar and unfamiliar.
iii. "The uncanny valley" and an explanation of the revulsion and fear experienced when something becomes 'too understood' = **people want to know something, but not everything**.

LINK: explaining the notion of *das unheimliche* and the uncanny

4 A loss of balance: **realising the 'uncanny'**

i. The Age of Enlightenment and analytical reason provided **science** with the opportunity to **replace religious beliefs**.
ii. **Psychological implications** of *das unheimliche* = the uncanny (Freud, Jentsch and Jung).
iii. What people had always believed to be divine intervention could be **explained with science** and reason.
iv. At first, architecture became blatantly decorative/superficial; later changing hands and overtly discarding the humanities – becoming a mechanism (Modernism).
v. Johnston (1988): architecture needs to return to a find a **balance between empiricism and rationalism**; go back to be **understood as an alchemic reaction** between the two.

6 Understanding the *unheimlich* in architecture

i. Uncanny, as a characteristic, is not necessarily a spatial configuration, but **spaces can be characteristically uncanny**.
ii. Vidler (1992, 1993) identifies the estrangement created by overt familiarisation versus not identifying at all.
iii. A balance between the two is found somewhere in the in-between; in **the void that finds itself in the midst** of association and disassociation (liminality and the threshold).

LINK: the design of laboratories and a balance of the *unheimlich*

7 Architectural implications: **combating laboratories as places of estrangement**

i. The architecture of scientific institutions has become overly pragmatic.
ii. Design can have a **fundamental impact on scientific innovation** and allow for representation of the merge between science and philosophy, **returning to a sense of alchemy**.
iii. Interdisciplinary action on a social plane.
iv. Emphasising the importance of the human being who has to conduct scientific research within the laboratory; laboratory design needs to **incorporate aspects of humanism** (emotive qualities, spiritualism).

LINK: how a sense of *civitas dei* can be brought to the scientific institute

9 An alchemic equilibrium: the pragmatic scientific institute and the emotive human being

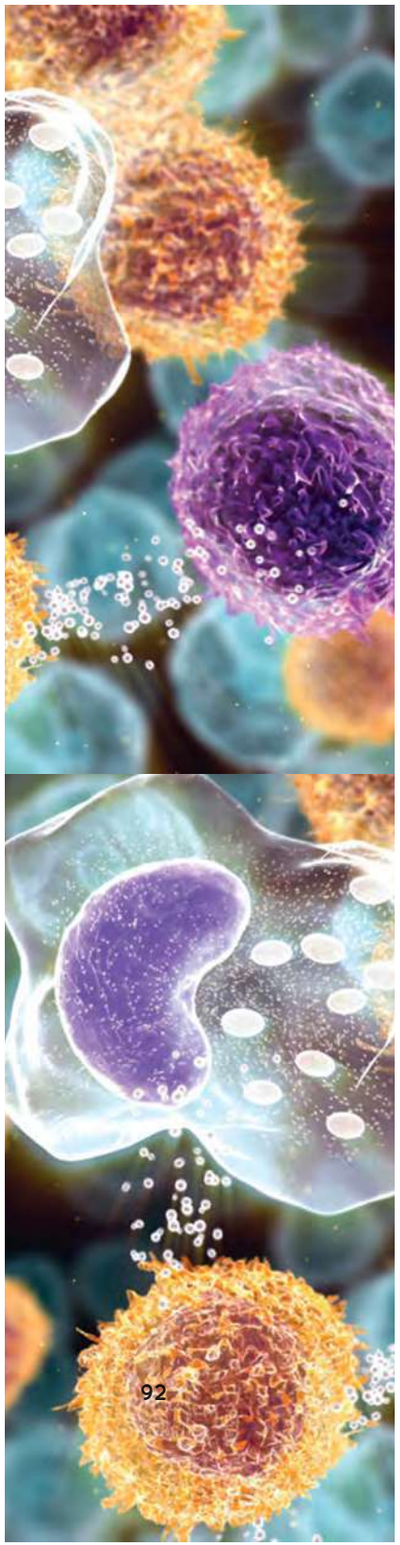
The welcomed intrusion of nature, ruin and ritual as a means of restoring balance

i. Colomina (2008): modernisms reaction to the natural environment as unsanitary; contaminated.
ii. **Modern architecture** (specific architectural elements) as a **medical device** to combat this contamination; a removal from the natural world (and associated schools of thought).
iii. In the scientific institute, the laboratory: **the human being behind the scientist was disregarded**.
iv. The 'stagnant, white box' of the laboratory needs to be challenged: elements of **nature, ruin and ritual need to be reincorporated** where possible – these are aspects which human beings are primitively familiar with; **they create a sense of the familiar**; an understanding (place-making = identify and orientate).
v. The **ritual spaces** of the scientist as **opportunities** to integrate these aspects into the design of laboratories and **restore a sense of balance**.

LINK: seeking an approach to design

8 Lessons from I.M. Pei and Louis Kahn: **creating a 'sacred science'**

i. A brief discussion of Louis Kahn's Salk Institute and I. M. Pei's Mesa Laboratory at the National Centre for Atmospheric Research.
ii. The effect of Kahn's approach to "listening to silence and learning to see light" (**becoming something experiential**).
iii. Creating the **sacred from the profane**.
iv. **Rethinking** traditional disciplinary **boundaries** and imagining new scientific disciplines.



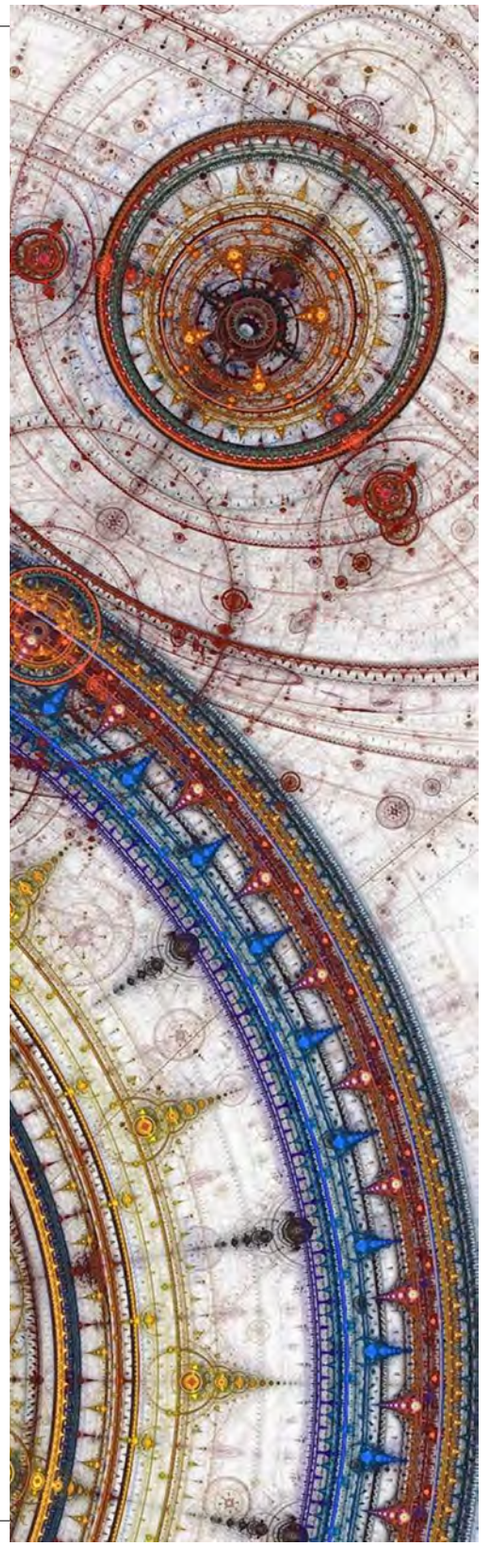
INTRODUCTION: MICROBIOLOGY LABORATORIES AS A MYSTERY

In the history of humanity, the endeavours of science have long been a realm little understood by the everyday person. We are more educated with regard to the workings of our world than we have ever been, and through subjects taught at school, many children leave these institutions with a basic understanding of biology and the physical sciences. Nonetheless, there is still much of what can be deemed the practice of the scientific world that is largely veiled in mystery. The inner workings of scientific research and clinical laboratories are not common knowledge. Unless specifically researched, people who have not specialised in one of these fields have little to no understanding of the processes behind many of the developments that shape our lives in fundamental ways. Essentially, microbiology laboratories are the places where the chemical and biological implications of everything we do, eat, and interact with are researched with the intention of being understood. These aspects remain a mystery to the everyday person; comprehended only by the scientific researcher – in effect, the contemporary alchemist.

With regard to the likes of microbiology studies, which deal primarily with disease, a radically growing and dramatic presence in the lives of people, there exists the opportunity to unveil some of the work that determines what society is permitted to know about disease. Even so, some of what goes on behind laboratory walls needs to remain private for the sake of the scientist, the psychological state of the everyday person, and the continuation of fair competition between rival research firms. People involved in fields of microbiology research are the owners of specialist knowledge. They have undertaken a certain level of unique training in dedicated facilities and have learnt how to conduct very specific work. The everyday person may experience feelings of unease if everything about this field of study were to be revealed to him.

In other words, the contemporary microbiology laboratory needs to find a balance between celebrating the scientist as the modern-day alchemist while still achieving some sense of discretion. In doing so exists the challenge to seek equilibrium between assembling public awareness without creating frenzy; reconciling the mysteries of science with humanist philosophies and schools of thought.

IMAGE (LEFT): Rendition of microscopic organisms. Because the world of microorganisms is invisible to the naked eye, it is largely veiled in mystery. *(Source: World Journal of Clinical Pharmacology, Microbiology and Toxicology - http://wjcpmt.com - accessed 16 June 2015).*



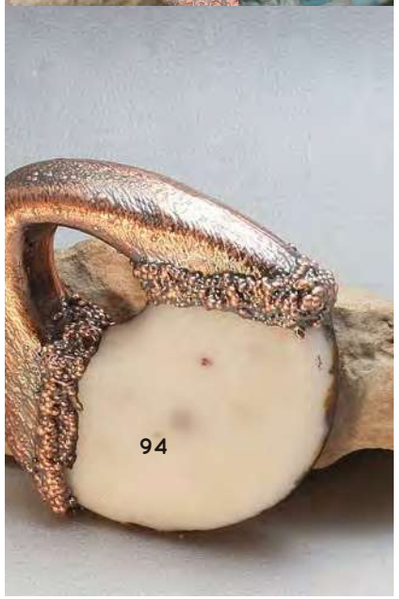
SCIENTIFIC MYSTICISM: ALCHEMY AS A BASIS FOR MISCONCEPTION

The practice of alchemy first developed as an art amongst the likes of the ancient Egyptians, by whom it was cultivated as an early form of chemistry and metallurgy. Egyptian alchemists refined a specific knowledge with regard to certain chemical reactions and the physical and chemical behaviour of metallic elements. This knowledge was applied to make metallic alloys, which were used in sacred art and the making of jewellery, dyeing of fabrics, and creation of perfumes. Importantly, these alchemists developed the practice of embalming the dead by utilising their knowledge of what could impede the natural process of decomposition. It is for their art, employing techniques not understood by their broader community, that these alchemists were revered as having supernatural, mystical skills (Newman, 2011: 314).

In definition, the word alchemy deals with a form of chemistry intertwined with philosophy that was practiced in Europe during the Middle Ages and the Renaissance. During the medieval era, alchemy spread through the Western world, developed further by various occults practitioners, operating on both physical and spiritual spheres of thought. Alchemy was primarily concerned with discovering methods of converting less precious metals into the likes of gold and silver; the essential aim of these conversions was to transmute a somewhat common substance into something of significant value (Newman, 2011: 315). The philosophical aspect of alchemy at this time followed a similar premise: alchemists worked to "purify" themselves by eradicating the common substance, that is, the self and materialism, and hoped to achieve the more valuable status of "enlightenment" – a kind of nirvana. Many alchemists believed that without the inner sought-after purification, the physical act of transforming metals could not be achieved. The primary means of achieving this state of nirvana, as believed by alchemists, was through contemplation, reflection, and a close connection to nature. The alchemist, after all, spent the majority of his time discovering the mysteries of the natural world (Principe, 2011: 306). It is not difficult to see how such practices became shrouded in esotericism and mystery.

IMAGE (LEFT): The practice of alchemy put great emphasis on the idea of "sacred geometry" and the notion that the same patterns seen within the micro-world can be correlated to the macro-world. *(Source: The Geometry Code - http://www.geometrycode.com/sacred-geometry/ - 1 August 2015).*

IMAGE (RIGHT): "The Summoning", rendition of an alchemist, by Sharna Tonkin (n.d.). *(Source: Deviant Art - http://sharnatonkin.deviantart.com/art/the-summoning/ - 1 August 2015).*



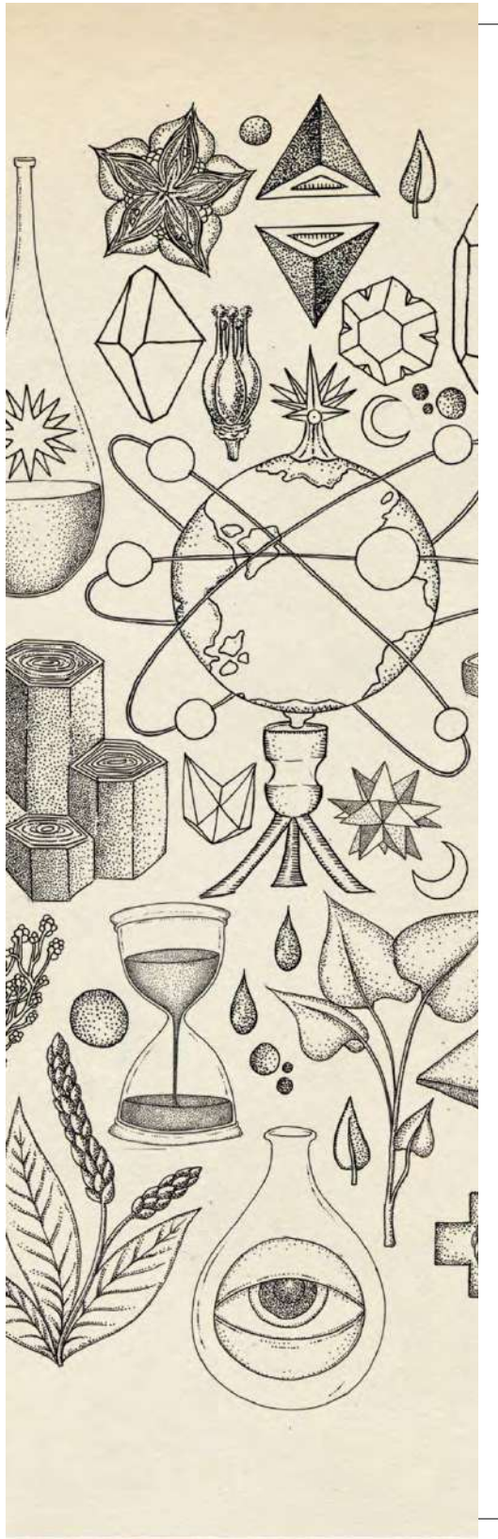
Contemporary society understands plating as a means of depositing metal onto a conductive surface, and many forms of metal-plating are in fact essential to modern technology. Nonetheless, during the Middle Ages, when alchemists discovered how to deposit a thin layer of gold onto the surface of a metal like copper, they were revered as magicians, having seemingly transformed the copper into gold (Newman and Principe, 1998: 34). Without background knowledge of the electrolytic processes that make plating possible, people drew their own speculative conclusions about how alchemists were capable of exercising these so-called powers.

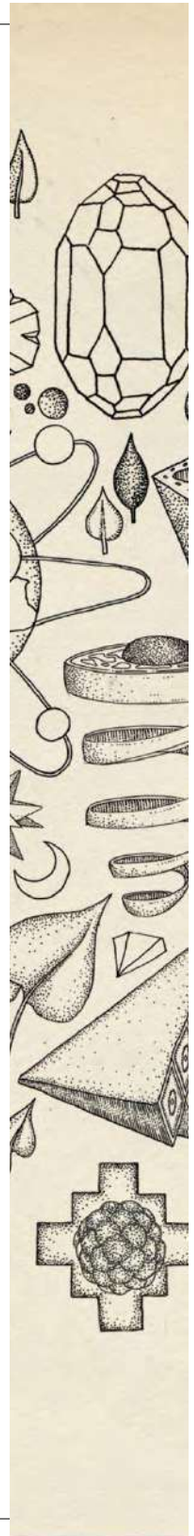
At a time when Catholicism and other Christian doctrines were gaining support and official power in Europe, alchemists acquired reputations as magicians and sorcerers. Although it was not a dogma that defied the church, and even though many alchemists were themselves "conventionally religious" physicians and chemists, the practice of alchemy was often deemed "evil" – a diversion from the contemplation of the Christian scriptures and system of values (Newman, 2011: 318). This was an era in history where the ability to read and write was granted only to a privileged few, implying that a general ignorance and lack of education with regard to aspects of science cultivated a fear and misunderstanding thereof that would only begin to unravel as centuries passed.

By the Renaissance, alchemists in Europe had separated into two factions. The first pursued the metaphysical aspects of alchemy, such as the actual transmutation of a base metal into gold and a quest for immortality, an apparent "elixir of life". The second faction remained focused on the discovery of new metal-amalgamations, documenting further chemical processes, and developing the apparatus and laboratories required to do so. It is this group that lead to the science that is now established as chemistry (Newman and Principe, 1998: 37).

IMAGES (LEFT): Electroplating and electroforming allow for the apparent transformation of ordinary objects into precious, valuable items. *(Source: Electroformed Copper Pate de Verra Glass by artist KimVGlass - http://www.kimvglass.com/ - accessed 5 August 2015).*

IMAGE (RIGHT): "Magical Science" by illustrator Katie Scott, 2013. *(Source: http://www.artnau.com/2013/08/katie-scott/ - accessed 1 August 2015).*





ARCHITECTURE AS "TRUE ALCHEMY": A BALANCE OF AMALGAMATION

Architecture, as practice and philosophy, balances somewhere between an art of humanities and a field of science. Therefore it can be correlated to an original understanding of alchemy as both an esoteric and a scientific practice. Furthermore, when one considers the premise that architecture will always seek to physically reflect a certain societal zeitgeist, architecture can be related to alchemy as "the attempt to demonstrate experimentally on the material plane the validity of a certain philosophical view of the Cosmos" (Redgrove, 1969: 1).

Johnston (1988: 11) illustrates the practice of architecture as a kind of alchemic amalgamation of historic cultures that took place over centuries, identifying the birthplace of this cultural, chemical reaction in ancient Alexandria, Egypt. Alexandria offered the ideal meeting place for the supreme construction technologies of the Egyptians, who sought perfection in material and assembly; and the ancient Greeks, who pursued the same perfection in terms of rationalising ideals observed in the natural world through philosophical discourse. In other words, it is through the balance of technology and philosophy, the masculine and feminine, emotion and reason, that architecture, like alchemy, is realised. Where the architecture of the ancient Greeks and Egyptians could bring forth physical representations focused on their polytheistic beliefs, the development of Christianity and monotheism, as seen in early Christian architecture, brought a third element to the "chemical reaction": creating a sense of spirituality. As Johnston (1988: 11) explains, architecture was further tasked with capturing a certain "spirit of the place"; seizing a sense of divinity and creating places that can be likened to "heaven-on-earth", *civitas dei*, thus forging a connection between spiritual and secular domains.

IMAGE (LEFT): Venn diagram conveying architecture as the amalgamation of science and technology, philosophy, and a sense of the soul, expressed by many as spirituality.

A LOSS OF BALANCE: REALISING THE "UNCANNY"

Technology and human endeavour developed and started explaining many of the great mysteries of life; universal secrets were made "un-secret" and through an age of enlightenment, science could replace religion as the prerequisite allegory of reality (Johnston, 1988: 12). It was during the Age of Enlightenment (1620s–1780s), when intellectual reason and free-thought individualism was emphasised, that the psychological implications of the "uncanny", *das unheimliche*, to be studied later by the likes of Jung, Jentsch and Freud, were made recognisable. As analytical reason and scepticism challenged long-held traditional religious creeds and the authorities that imposed them, members of society were faced with the decision to either accept the revolutionary ideas brought to them by scientific discovery, even though not necessarily always understanding them, or cling to their religious beliefs as familiar comforts of understanding. These new ideas had immense psychological considerations: what was once believed, what had always been believed, was simply no more – rational, scientific laws of physics and chemistry could finally explain what had always been attributed to a divine power. The world, a familiar place, was abruptly inundated by details of unfamiliarity.

These facets of unfamiliarity and uncertainty that affected the psychological state of society were expressed in cultural signifiers of art and architecture. The reaction between the structural, speculative and metaphysical that had successfully generated architecture was, to a certain extent, lost during more "decorative" periods in the architectural history of certain styles. Architecture waned toward the "dressing of buildings" and gave structure over to the practice of engineering. When this was remedied, and decoration disregarded, modernists replaced the nature of being focused on humanities with that of the automaton. Johnston (1988: 12) argues that, at some point between the time of the Italian Renaissance and the French Enlightenment, architectural tradition was cloaked as "one or the other", and that perhaps there is a diverse need for architecture to amalgamate the spheres of the structural, speculative and metaphysical as an alchemic art, even in secular architecture, once more. It is this amalgamation that may be the antidote for the apparent architectural divides and feelings of uncanniness and unfamiliarity that stem from it as *das unheimlich*.

IMAGES (LEFT): "Mechanical Brides of the Uncanny" by Edward Bateman, 2009. An expression of humanity's technological creations looking back at us from history. *(Source: http://scienceblogs.com/bioephemera/ - accessed 24 July 2015).*

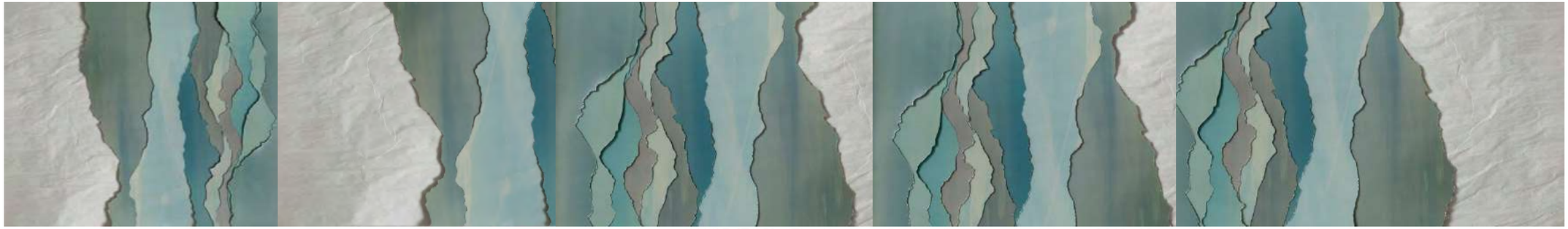
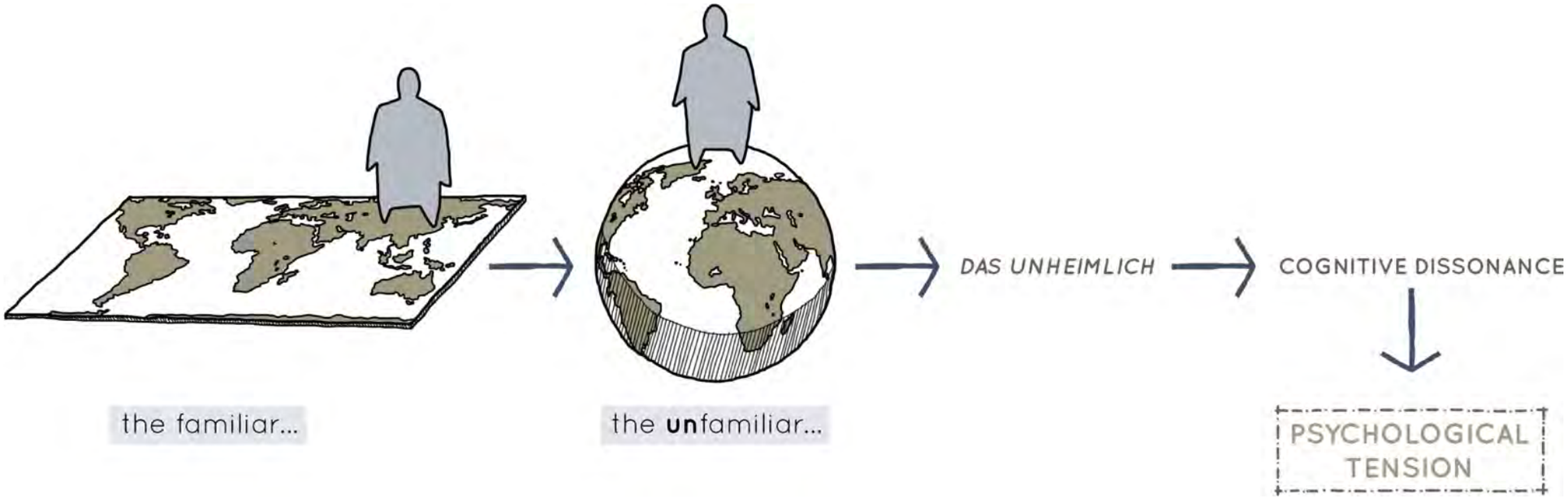


IMAGE (TOP): "The Heaving Surface" by Savannah Lynn, 2010. *(Source: http://www.theheavingsurface.tumblr.com/ image - accessed 9 September 2015).*

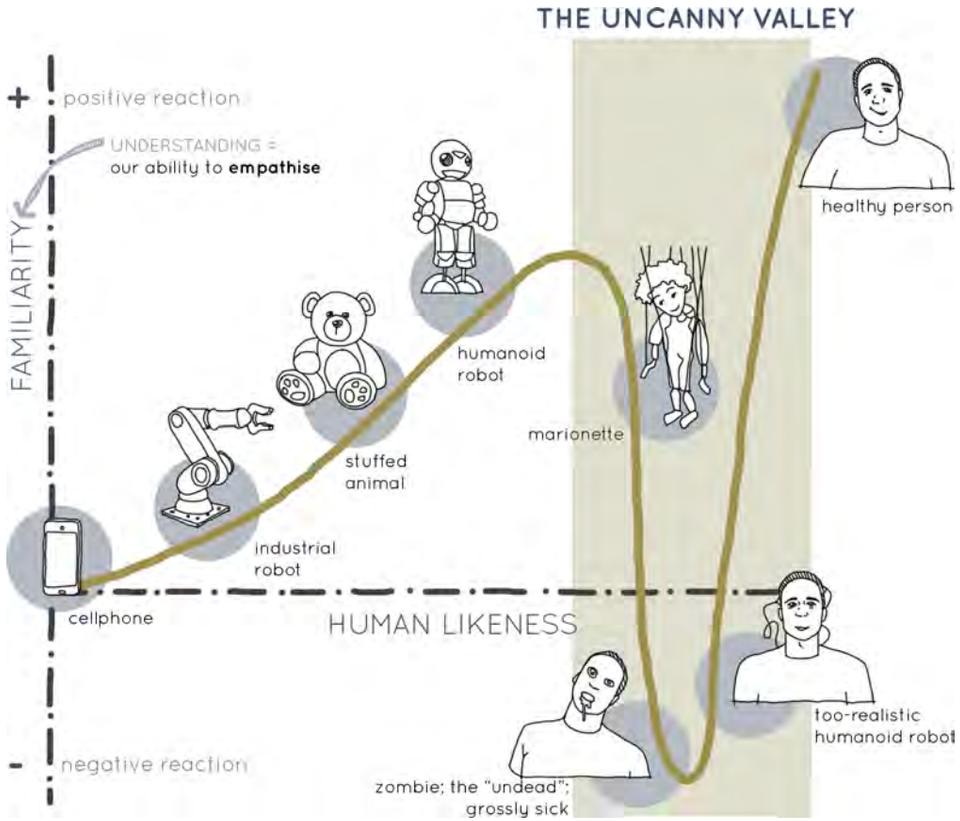


For centuries, human beings believed that the earth was a flat surface. This is, after all, is the way in which we physically experience it on a daily basis. Through human endeavours and technological developments, it was revealed that the world was in fact spherical. This feeling of all that was once familiar to a person being turned upside down; proved incorrect, can be correlated to psychological dissonance. It is often easier for people to hold onto certain beliefs, even if illogical, because they are comforting. If too much is explained; too much revealed and the unfamiliar made wholly "un-secret", people experience a sense of psychological tension that they would rather not comprehend. Therefore, scientific rationalism is often disregarded in favour of somewhat unfounded beliefs, as the truth may be too difficult to grasp.

DAS UNHEIMLICHE AS "THE OPPOSITE OF WHAT IS FAMILIAR"

The German word for uncanny, *unheimlich*, is frequently misinterpreted as meaning "unhomely". The correct meaning is in fact "un-secret" – the hidden that has been revealed, but would have been easier to deal with had it remained hidden (Del Rio, 1993: 178). The uncanny is all about paradoxes, inequalities, uneasiness, being unable to decide. Ultimately, it can be linked to tension and a lack of balance.

The uncanny is experienced as something peculiar because it is a mixture of that which we understand as familiar and unfamiliar at the same time, which creates this notion of tension. Something can be uncanny because of a sense of strange familiarity, making it mysterious. Because of the psychological paradox experienced with that which is uncanny; finding something familiar yet strange and incongruous, one is simultaneously attracted to and repulsed from an "uncanny object". The result of this experienced paradox is cognitive dissonance, a kind of mental stress and discomfort caused by experiencing these two contradictory and inconsistent emotions at the same time. One is essentially in a kind of psychological tension. In most cases, this dissonance results in a rejection of the object, as it is perhaps easier to discard this tension than rationalise it (Boring, 1964: 681).



In a society where technology has such a strong impact on our daily lives, the notion of robotics can be used to explain this dissonance in relation to something uncanny. Thus far, in areas privileged enough, human beings seem to have enjoyed the comforts that modern technology and leaps in robotics development have brought to our lives; they have assisted in raising our standard of living. In 1970, robotics professor Masahiro Mori, based on Ernst Jentsch's essay, "On the Psychology of the Uncanny" (1906) and Sigmund Freud's "Das Unheimliche/The Uncanny" (1919), hypothesised about what he termed as the uncanny valley. He states that if a robot's appearance is made more human; more familiar, then the possibility for positive acceptance and even empathy towards the robot is increased. However, if the robot is made to be too human and overly familiar, this response of acceptance can quickly turn into revulsion and fear – the uncanny valley is this region of negative emotional response (Robinson and El Kaliouby, 2009: 3442-3444).

The uncanny is by no means a new concept. As stated, the likes of Jentsch and Freud, and later Carl Jung, fixated on the psychological subject over a century ago. It has remained a subject of great interest, discussed in fields of psychology, exemplified in literature, and psycho-aesthetically explored amongst artists and architects.

IMAGE (LEFT): Graph portraying the relationship between human likeliness and our ability to express empathy. Redrawn and edited from author Frank Tobe, 2014. (*Source: www.therobotreport.com/the-uncanny-valley-theory - accessed 14 April 2015*).

UNDERSTANDING THE *UNHEIMLICH* IN ARCHITECTURE

When applied to architecture, the uncanny encompasses various representations of estrangement over a broad cultural and historical expanse. It ranges from the feeling of unease, which was identified in the late-eighteenth century, upon the age of Enlightenment, with the practices of Romanticism, deemed as "anxiety-ridden" (Del Rio, 1993: 178), to equally anxious free-floating, visually-driven architectural and spatial signs of the post-modern period. The uncanny, as a characteristic, so to speak, is not the property of the space itself, and it cannot be implemented as a design element by a specific spatial configuration. Nonetheless, certain buildings and spaces have been seen as emblems of the uncanny and become cultural signs of estrangement for particular periods in human history (Vidler, 1992: 20).

Vidler (1993: 37) claims that estrangement is a product of the rapid oscillation between two characteristic moods of urban life: identifying with things over-closely, and the alternative, which is a great distance of familiarity from them. Therefore, our understanding of space, and experience thereof, is both physically spatial and psychological. Because spaces are the effects of human activity, they are important indications of social process. The interaction between people is seen as that which fills space, while the space between individuals, the empty space, is in fact also filled and activated by the mutual relations between beings and their environment, highlighting the "in-between" as both a spatial and a functional concept to reconnect with "estranged places". Relating the familiar and unfamiliar becomes ambiguous through the in-between, essentially the void.

IMAGES (RIGHT): Vidler (1993) uses an idea of the romanticised haunted house to convey an expression of the architectural uncanny. Essentially, the house is familiar to us - it evokes a sense of primitive shelter and protection from the elements. When this notion is disrupted, part of this feeling of comfort is removed; the house is not a home or a safe place of privacy and becomes an emblem of the *unheimlich*. This connoatation is not necessarily negative, as human beings are naturally intrigued and fascinated by that which we consider eerie.

1. "Untitled Backyard" - *https://thecatisginger.files.wordpress.com - accessed 23 April 2015*
2. "Junk House" - *https://newtrendmagazine.files.wordpress.com/2014/02 - accessed 25 April 2015*
3. "The Uncanny Mirror" - *https://http://goinvade.com/ - accessed 25 April 2015*
4. "Forgotten Church" - *http://tommyandersson.com/portfolio/ - accessed 23 April 2015*
5. "Nobody House" - *http://tommyandersson.com/portfolio/ - accessed 24 April 2015*
6. "Leftover Mansion" - *http://thebalckhatsociety.com - accessed 25 April 2015*


1


2


3

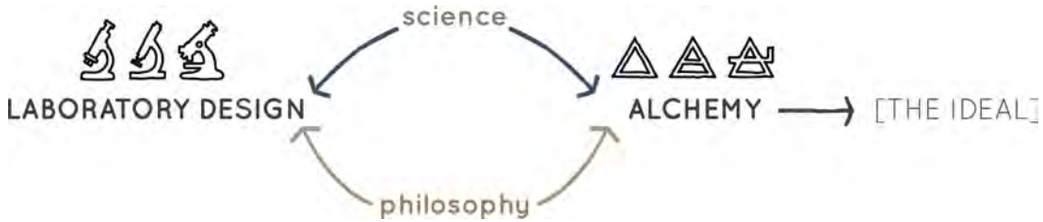

4


5

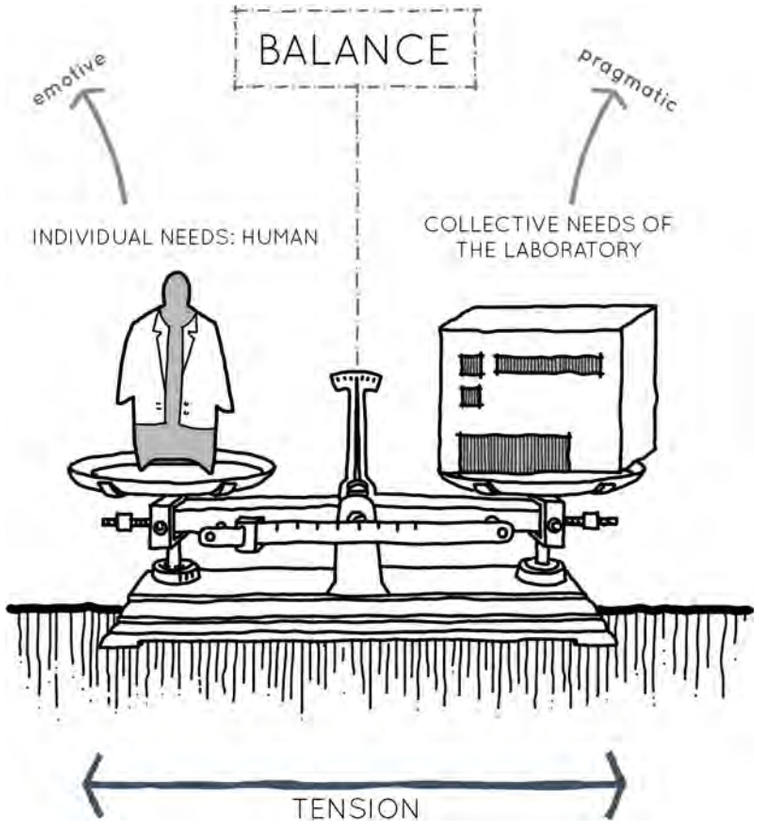

6

ARCHITECTURAL IMPLICATIONS:
COMBATING LABORATORIES AS PLACES OF ESTRANGEMENT

Cohen (2000: 210) argues that laboratories have long been the plainest of buildings, with aspects of design emphasising function over experience in almost every single case. However, there have been recent moves towards an understanding of this "architecture of science", whereby it is believed that design can impact scientific discovery – that architectural innovation can spark scientific innovation. In recent history, the laboratory featured frequently in current affairs, and manages to evade the economic crisis and the general mood of recession experienced in other social disciplines. More importantly, it has a philosophical, symbolic significance that is vital to architects. In a certain manner, the design of laboratories allows architects to reconnect with that notion of alchemy that Johnston (1988: 11-13) argues has been lost.



The amalgamation of science and architecture deals with more than visual appearances, aiming at creating environments in which interdisciplinary interaction can occur on a social plane, while still providing spaces of privacy. Therefore, an aspect of humanity, of keeping the human being in mind, is essential in avoiding the design of an estranged place. An expression of totalitarian power or rather lack thereof, is also essential for the design of the laboratory space. No one person should lord over another; rather, space and management should be open and flowing – disallowing the dangerous predicament of scientific work associated with territoriality (Cohen, 2000: 213). The most important variable in the laboratory remains the person conducting the research and experimentation – the work of science. Therefore, it can be argued that better science can be conducted in a building that adheres to human needs of comfort, identification, familiarity and orientation – all essential aspects of true place-making. Laboratory architecture stabilises scientific practice in that a social philosophy of research is embedded within its structure, one which persists long after the initial aim and mission that initiated its construction has been forgotten (Leslie, 2008: 173). A signature laboratory can provide prestige, visibility and a collective, social identity – rather than alienating society, keeping secrets, or inventing methods of exclusion.



It is with this understanding that the experience of laboratories can be placed within the Freudian notions of *heimlich* and *das unheimlich*. Scientific laboratories need to fall somewhere between the experience of the familiar; to be related to by the scientist and partially understood by the outsider, but still maintain a decree of discretion so as not to slip into the realm of revulsion, as characterised by the "uncanny valley". Therefore, it could be the insertion of sanctified ideologies into scientific rationalisms that brings forth this balance.

LESSONS FROM I.M. PEI AND LOUIS KAHN: CREATING A "SACRED SCIENCE"

Kahn listened to Silence and learned to see Light. On that threshold between Silence and Light is where Kahn fixed with a stake the head of the snake, forging sacred from profane. On that fixed point, that centre, he made his offerings to Architecture (Johnston, 1988: 12).

The Mesa Laboratory at the National Centre for Atmospheric Research (NCAR) in Boulder, Colorado, designed by I. M. Pei, and Louis Kahn's Salk Institute in La Jolla, California, architecturally exemplify the collaboration between imaginative architects and visionary scientists. The institutions were designed with the intent of expressing concretely two distinctive philosophies of research (Leslie, 2008: 174). In both cases, the architects utilised the opportunity to design a laboratory as a chance to reconsider the established boundaries that had long existed between disciplines within the scientific field.

THE MESA LABORATORY, 1961 (I. M. PEI)

In an article entitled, "A different kind of beauty: scientific and architectural style in I. M. Pei's Mesa Laboratory and Louis Kahn's Salk Institute", Leslie (2008) argues that the role of the scientific laboratory is part of the image of the people that operate inside it; the building becomes an icon of what they do and how this work is conducted. According to Leslie (2008: 178), renowned solar astronomer Walter Roberts, founding director of the Mesa Laboratory at the NCAR, was inspired by a place of "complexity, communication and creativity". Roberts had been motivated by a notion similar to the concepts discussed in that of Jane Jacob's "The Death and Life of Great American Cities" (1961), sustained by diversity and interdependence. He believed that when it came to designing laboratories, beauty was found in the small and subtle; the relatable. Roberts discussed ideas of exterior offices and interior laboratory spaces arranged on a rectangular plan with an encircling corridor in between, so that there would be "twenty different ways" to travel from his office to one of the laboratories.

Once Roberts had tasked Pei with the design and construction of his atmospheric research laboratory, the team began a rigorous investigation into the needs of both the intended programme and future occupants. Consultations highlighted the need for a predominantly horizontal orientation that encouraged a sense of community. Furthermore, people spoke adamantly for the inclusion of private offices, protected from intrusion and noise, while still within convenient walking distance from their colleagues. Most interviewees were also inclined towards rooms with views and sufficient natural light. More importantly, according to discussions with scientists and first-hand visits, "every laboratory was lacking in soul" (Leslie, 2008: 183-184). Roberts had a certain ideal that he wanted his architectural team to express; namely, an informality of the scientific institution that allowed it to surpass a typical notion of the workplace. Essentially, he wanted to give the laboratory back to the person who largely occupied it, stating that "the scientist must feel free to tack things on the wall, or anchor things to the floor... an air of incompleteness, of non-finality, is essential to a good scientific environment" (Leslie, 2008: 186).


1


2

Pei approached the design of the Mesa Laboratory by restructuring the conventional premise of organising a laboratory by discipline. In fact, so-called "serendipitous encounters" were encouraged by providing employees with places to pace and vent their frustrations, and small, more irregular niches where they could sit and think. Roberts remained an essential part of the design team throughout the conceptual and construction process, consistently informing design decisions by explaining details of the ritual of the scientist that could be applied as lessons to contemporary situations, speaking of the importance of opportunities to interact within small groups. Pei was warned against the "Hollywood version" of the laboratory that displayed long, sweeping corridors, with Roberts encouraging a more human scale, reminiscent of Greek island towns. Roberts also explained that scientists would work in teams of three to ten people and would always need access to blackboards, which he stated is the "real instrument of interdisciplinary work" (Leslie, 2008: 186-188). Granted, the Mesa Laboratory was completed in 1961, and communicative technology has developed dramatically since then. Nonetheless, the principle remains something to be learnt from.

Ultimately, Pei's design for the Mesa Laboratory could be likened to a mountain-retreat, nestled within the surface of its site. Pei explained that, by spreading out the buildings and breaking the mass of the programme required, the different parts of the laboratory could talk to each other and develop an architectural language of interdisciplinary communication. His design allows the scientist to avoid the feeling of frenzy normally experienced in spaces of similar instruction, creating a place that seems alternatively relaxed and peaceful (Leslie, 2008: 191).

IMAGES:

1. North tower of the Mesa Laboratory. Hoods are included at the top of the towers, above the entrance, and along small rows of windows. The oversized scale of the building, emphasised by the vertical orientation, is made more human by these hoods, especially that over the entrance, shown by the figures in the photograph (Leslie, 2008: 188).
2. The Mesa Laboratory set against the backdrop of the Flatiron mountain range. The scale, aided by the flat roofs and hooded towers is intended to be deceptively large (Leslie, 2008: 177).
3. A courtyard and water feature at the laboratory complex, intended to provide a relaxed and peaceful environment (Leslie, 2008: 191).
4. Interior view of one of the laboratory spaces. The space is not claustrophobic and allows for a connection to nature by including views onto the mountain range (Leslie, 2008: 198).

THE SALK INSTITUTE FOR BIOLOGICAL STUDIES, 1965 (LOUIS KAHN)

In line with this notion of restfulness, acclaimed virologist Jonas Salk, who developed the first successful polio vaccine, believed that it was vital to provide scientists with spaces of contemplation and creativity within their working environment. He argued that "science laboratories are essentially studios." According to Salk, the ideal model for a laboratory was a monastery, one of the earliest planned communities and places of retreat. Kahn, who grouped laboratories with churches and other "houses of inspiration", also saw monasteries as a representation of the ideal space for learning, teaching and reflection (Leslie, 2008: 199-201). Furthermore, Salk embedded a certain philosophy within his intentions for a scientific institution, one that focused not only studying and understanding disease, but which also sought to address prominent issues of humanity.

The Salk Institute broke away from conventional institutes of its kind by employing both scientists and humanists, seeing both as equally important entities for understanding these problems of humanity. Salk claims that it was his 1954 visit to the commune of Assisi in Italy that inspired him and "opened his eyes to new ways of producing the polio vaccine" through its collective spaces, the play between light and shadow, the mixture of colours and textures of the built environment – an inspiration which he hoped would be conveyed in his new institute (Leslie, 2008: 204-208). Essentially, his vision was formulated through an understanding of the appropriate balance between communal life and the need to be solitary.

According to Leslie (2008: 209), Kahn divided the design into separate elements of specific purpose and form, namely the Laboratory Group, the Meeting House Group and the Residences. Laboratory spaces were treated as large open workspaces and adjoining studies, emphasising the flow of fresh air. The studies were given particular attention as ritual spaces; they were treated as private rooms for contemplation and work, separate from the distraction of external influences, each with its own chairs, couches, reading area with bookcases, chalkboards, private ablution facility, and view onto the gardens. The Meeting House, on the other hand, was the place for conversation and reaction, where interdisciplinary interaction could be fostered, which, according to Kahn (Leslie, 2008: 209), symbolised the overall purpose of the Institute. This interaction was encouraged by the communal dining room, a library, seminar locations, and auditorium, and other recreational spaces for the staff, such as a gymnasium and sundeck.


1


2


3

Furthermore, the Meeting House component also provided an overnight dwelling for the director. The Meeting House and Laboratories defined one another as components of the Institute; the Laboratories for discovery and the Meeting House for reflection, both focused on the importance of questioning rather than a preoccupation with finality and definitive answers.

Kahn, much like Pei, sought to visually transform concrete into stone, alluding to the notion of the monastery once again and initiating a sense of the architectural ruin. Structurally, Kahn's innovative design approach allowed for laboratories of previously unprecedented dimensions and open span. Furthermore, with the piazza at Assisi as inspiration, the courtyard was initially designed as a tree-lined garden, later transforming into a plaza entirely paved in stone, emphasising a certain cathedral-like space. It is this courtyard that has inspired photographers, with a definite poetic aesthetic composition. It is a somewhat sombre space bisected by a single channel of water that drops into a pool at the west of the building (Leslie, 2008: 212-214). Vincent Scully, a renowned professor of art and architectural history at Yale University, refers to this channel as a "cosmic corridor" (Leslie, 2008: 214), exemplifying the sense of the spiritual and divine that has been brought to this scientific institute through architectural intervention.

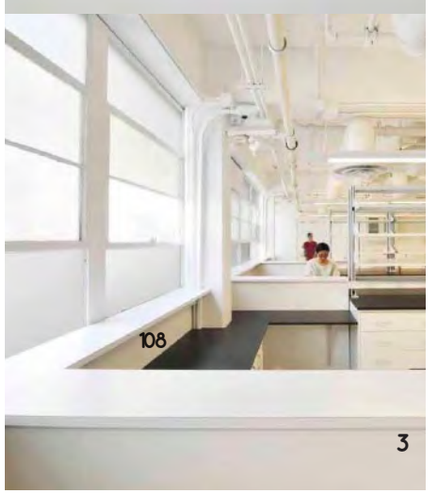
In either case, it is the inclusion of the human being and body in design considerations that was able to bring a sense of balance between science and imagination to the two examples. By understanding that although these buildings need to serve a purpose dedicated to scientific investigation, they would still fundamentally be experienced by human bodies on both a physical and emotional spectrum; the architects were able to approach the design of these institutes in a way that balanced these somewhat opposing spheres.

IMAGES:

1. The studies, arranged so that each has an unobstructed view of the Pacific Ocean, are flanked by a courtyard (Leslie, 2008: 200).
2. Kahn considered the scientist a "humanist philosopher", with the inclusion of study spaces suggesting the contemplative mood he had in mind. (Leslie, 2008: 210).
3. The "cosmic corridor" empties into a pool just below the centre of the courtyard (Leslie, 2008: 200).
4. Light and shadow play across the finish of the concrete, contrasting the teak shutters of the studies. (Leslie, 2008: 218).
5. Structural innovations allowed the laboratories to be expansive, open spaces (Leslie, 2008: 213).
6. The same evocations of a monastery are carried through to the interior (Leslie, 2008: 215).

1

2



3

AN ALCHEMIC EQUILIBRIUM: THE PRAGMATIC SCIENTIFIC INSTITUTE AND THE EMOTIVE HUMAN BEING

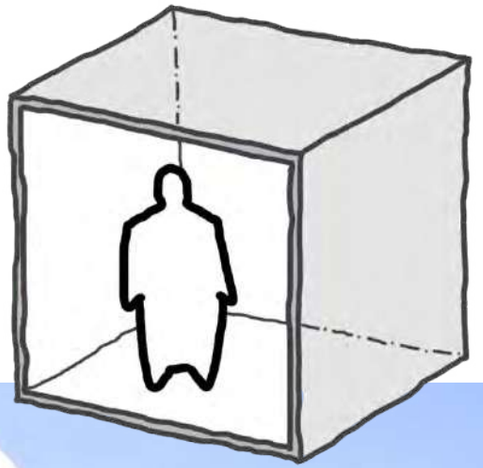
THE WELCOMED INTRUSION OF NATURE, RUIN AND RITUAL AS A MEANS OF RESTORING BALANCE

MODERNISM AND THE CHASM BETWEEN ARCHITECTURE, THE HUMAN BEING AND NATURE

Colomina (2008: 31) highlights the relationship between modern architecture and the way that modern technology can view the human body. In classical architectural paradigms the human body has always been a point of association; the means of distinguishing from and relating to a building. More importantly, it is our understanding of the body in medical terms that we relate to architectural theory, which is reconstructed with new theories of health and physiology. According to Colomina (2008: 32), the success of modern architecture was heavily dependent on the need to environmentally combat the new, fatal disease of the era, tuberculosis; a pathological zeitgeist of sorts. Architectural concepts of light, ventilation, exercise, roof terraces, hygiene, smooth surfaces and whiteness were offered as a defence against deathly disease and it ultimately formed part of a "healthy", upper-class bourgeois lifestyle.

In his book, "The Radiant City" (1935), Le Corbusier speaks negatively of the "natural ground" as the "dispenser of rheumatism and tuberculosis," declaring it the "enemy of man." Therefore, he insisted on detaching his buildings from this plane of the unhealthy – "the wet, humid ground where disease breeds". Le Corbusier developed the characteristic features of modernism – the roof terrace, pilotis, glass walls, clean air – as medical devices; the walls plastered and painted white to reveal any contamination (Colomina, 2008: 34). Fundamentally, architectural modernism, in its principles, sought to remove man from nature. It sought to create monuments that would effectively stand as defences against natural processes of disease and aging and effectively defeat "the terror of time" (Ginsberg, 2004: 261).

IMAGES (LEFT): Contemporary laboratories essentially place the scientist in austere white cubes.
1. Lordelo Pharmacy and Laboratory, 2012, Portugal *(Source: http://www.archdaily.com/313241/lordelo-pharmacy-jose-carlos-cruz - accessed 28 July 2015).*
2. Unilever Amora Dijon Mustard Laboratory, 2004, France *(Source: http://afasiaarchzine.com/2012/07 - accessed 1 August 2015).*
3. University of South Carolina's Pratt Cancer Research Laboratory, 2013, USA *(Source: http://www.interiordesigninhome.com/usc-pratt-laboratory - accessed 28 July 2015).*



Le Corbusier's Villa Savoye, France (1929), is the ideal example of the principles of Modern architecture. Even though it is situated within a natural setting, the foliage has been cleared and removed for a pristine, manicured lawn. The building, a residence, as much as it can be considered *beautiful*, is detached from the ground plane and with its almost all-white finishes, evokes a sense of the clinical. Villa Savoye is exemplary of the notion of placing the human being within a "clean" white cube.
(Source: http:// blogs.qu.edu.qa/ bach2017/ modernist/ villa-savoye/ - accessed 27 April 2015).

THE RUIN AS THE REUNIFICATION BETWEEN MAN AND NATURE

Human memory is closely linked to what we refer to as the "architecture of the mind"; the way in which we internally and subconsciously construct the world around us. Time is the element that becomes an integral link in binding an idea of memory to everyday life. Society, throughout history, has endeavoured to build certain defences against time by means of invention and experimentation. In other words, through the creation of art and architecture, humanity has attempted to eternalise a particular sense of time, place and thought – the zeitgeist. Architectural ruins, as conventional remnants of antiquity, become a cultural link to a previous epoch in humanity's history. Ultimately, these remnants – these ruins – stand as the counter-image of structures that seek to "defeat the terror of time" by presenting the superficialities of trying to achieve permanence (Harries, 1998: 242).

Ginsberg (2004: 285) clearly separates certain terminologies that people may confuse with a notion of the word "ruin" as an architectural concept. When something, or more specifically, a work of architecture, has been damaged, there is a "call for repair"; a need to fix it. This need is derived from the fact that the architecture, albeit damaged, has retained a definite sense of its identity. The community that valued this structure will want to restore it to its former glory, so to speak. The ruin is different in that, aided by the eventual, incessant passage of time, it has established a new, unique presence. Ginsberg (2004: 288) argues that an attempt at repairing the ruin to what it was in its "prime" would only tarnish the new identity it has attained over the ages.

It is the ruin that reminds us of the past, and in doing so, keeps what is now absent present. Herein lies the importance of the ruin as an architectural driving force, by displaying the value of what destruction may leave behind. The ruin becomes a reminder of humanity's transient existence on earth; coupling juxtaposed ideas of decay and monumentality to create an authentic sense of being.

"Ruin" texture source: http://freestocktextures.com/texture/id/395 - accessed 9 September 2015.

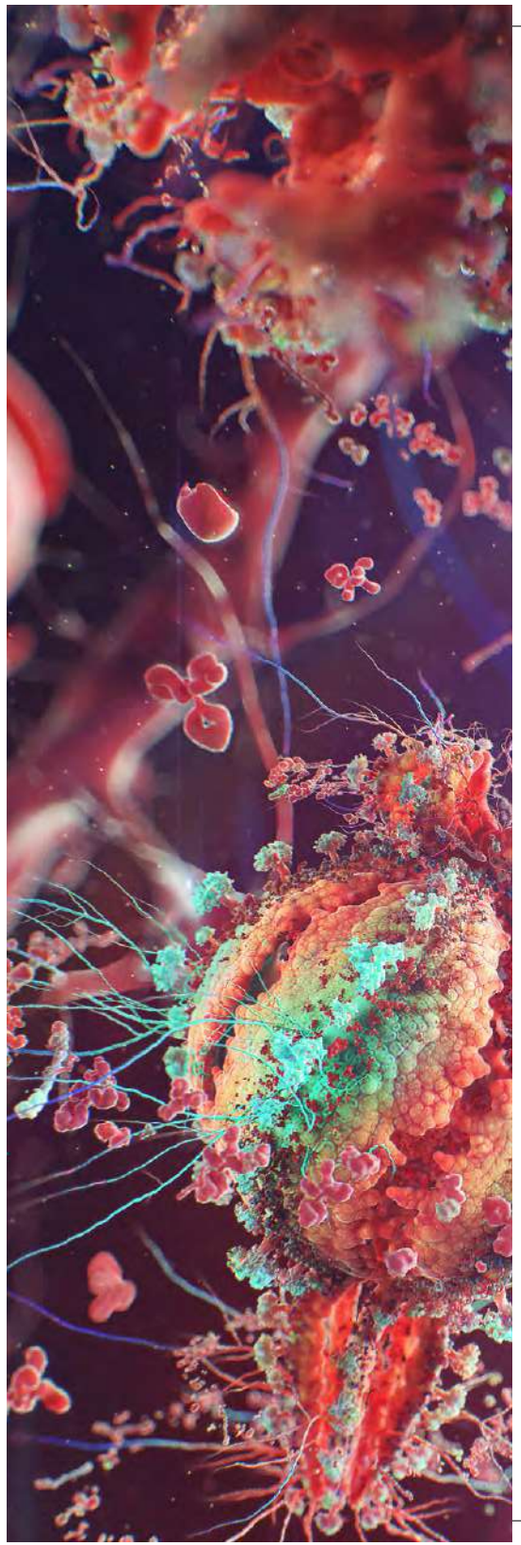
Harries (1998: 240-242) stresses the aesthetics of the ruin, arguing that straight lines and clean-cut edges are in fact detrimental to the human soul; that they perturb ease and comfortable dwelling. Therefore, these "flawless surfaces", often associated with the design of laboratories and Modernism as an architectural style, can have a negative effect on the human psyche; people inherently crave small reminders of decay and imperfection. The ruin, on the other hand, prompts our sense of mortality and therefore our sense of "particular self". Harries (1998: 250) argues that we value ruins because they are effective, tangible markers of time; a reminder of nature and its inevitable processes. It is this link to nature that brings forth a sense of what is familiar to us, becoming something we understand and can identify with. As the Roman playwright Terence (163 B.C.) wrote in his "The Self-Tormentor": I am a human-being; I consider that nothing natural is foreign to me (Ginsberg, 2004: 209).

THE NEED FOR INDIVIDUAL PLACE-MAKING AND RITUAL

Upon understanding the way human familiarity is fostered in the natural and somewhat organic, a means of bringing this notion to the "ritual places" of the scientist can be explored. A scientific institute, especially the likes of a microbiology laboratory, must serve its purpose of research and investigation. Smooth, clean surfaces, straight lines, sharp edges and filtered air are inevitable for a building within this typology – they are necessary for the building to achieve what it is essentially intended for. In saying so, there are other spaces in the scientific institute that can juxtapose this ideal; the spaces utilised by the scientist when he or she is not conducting laboratory work. The same spaces of study, interaction, reflection and contemplation that Pei and Kahn designed with such particular attention can be explored as opportunities of incorporating the aesthetics of the ruin; balancing the flawless white cube of the laboratory with the natural processes that make human beings comfortable.

In the same way that Walter Roberts envisioned certain facets of the Mesa Laboratory as "informal spaces" that the scientist can "feel free to make his own", Hundertwasser, the Viennese painter, stressed the importance of individualism in architecture; the need for people to be entwined with the buildings they inhabit beyond physical constraints (Harries, 1998: 240). Hundertwasser goes so far as to say that he would prefer a slum to "functional, utilitarian architecture" because the slum presents only the vulnerability of the body, of which we are already aware, whereas architecture that has been purposefully and apparently fully planned for people loses touch with natural forces, taking away from the human sense of soul. Without an individual, organic and naturally imperfect imprint on the building, the occupant has no real relationship with it. Although there is a certain beauty in geometric forms, even Plato recognised that this is not the only kind of beauty when opposing the aesthetic appeal of straight lines and perfect circles with the magnificence evidently present in animals and natural representations (Harries, 1998: 241).

IMAGE (LEFT): The places of ritual for scientists can be made more individual and the design thereof can be explored as the means for bringing something unique to the scientific institute, to engender a sense of "place-making". These places include the areas where they put their lab coats on in the mornings and hang them up again at the end of a day; where they meet to discuss ideas and gain insight into the thoughts of their colleagues; or simply the places they go to relax and get away from the confinements of the laboratory.
(Source: http://www.dialysisworldnigeria.org/post_images - accessed 9 September 2015).



Therefore, it is this understanding of the architectural ruin as a natural force, and a grasp of the importance of the ritual of the scientist, that can be brought to the design of a scientific institute, and a microbiology laboratory to be more specific. By realigning natural and spiritual philosophies that make human beings comfortable and encourage "dwelling" coupled with the striving towards precision that makes scientific investigation possible, a kind of sacred science can indeed be fostered.

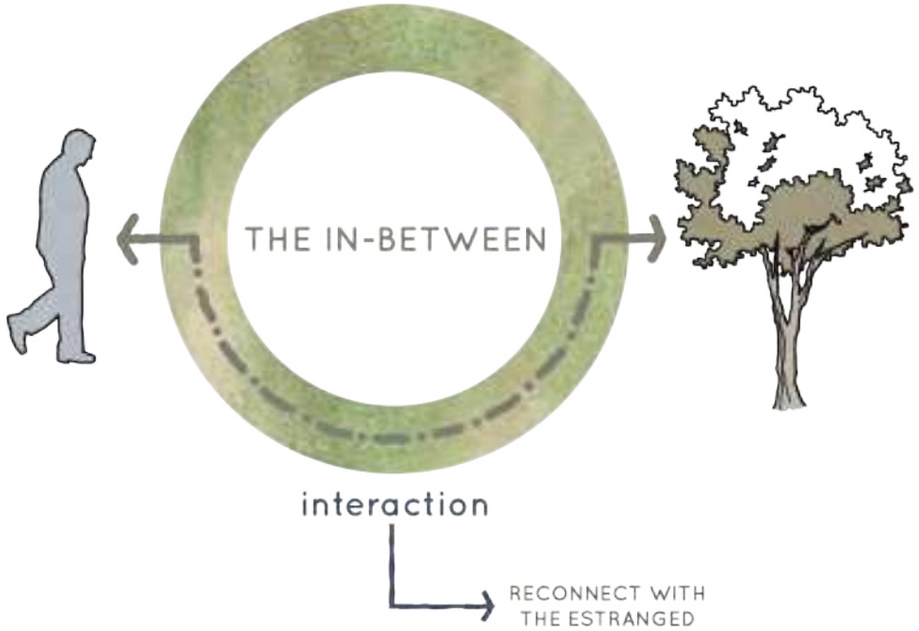
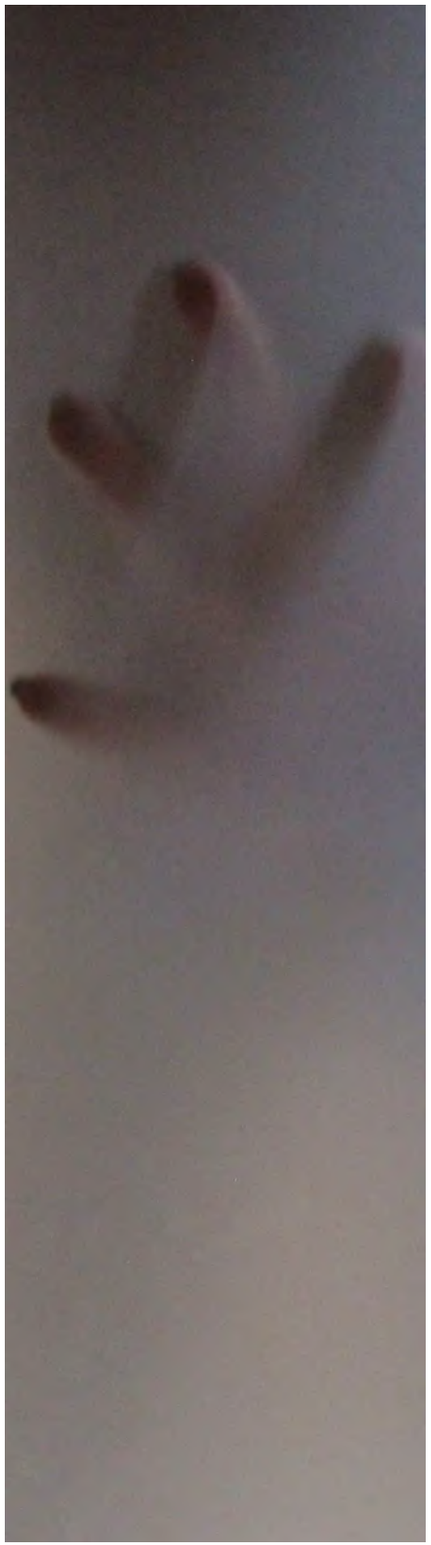


IMAGE (TOP): By fostering a sense of interaction between the scientist and natural forces, human beings may reconnect with that which has become estranged. In the same way that bacteria cultures grown in a petri dish can be perceieved as organic forms placed within an inorganic, perfectly geomtric setting, so too is the scientist, the human being, placed in the confines of the laboratory; the white cube.

IMAGE (LEFT): While most people are familiar with the visible effects of HIV on the human body, and the devastation it has caused in South Africa especially, we are not as familiar with the image of the virus itself. Ukrainian artists Alexey Kashpersky produced these visual renderings of the microorganism with the intention of conveying both the beauty and danger of these tiny alien forms. The artist wanted to express the complex relationship human beings have with the virus; that the exquisite organic complexity of the natural world can even be found in deadly viruses. *(Source: http:// http:// kashpersky.com/ hr/ HIV_wide.jpg - accessed 3 July 2015).*

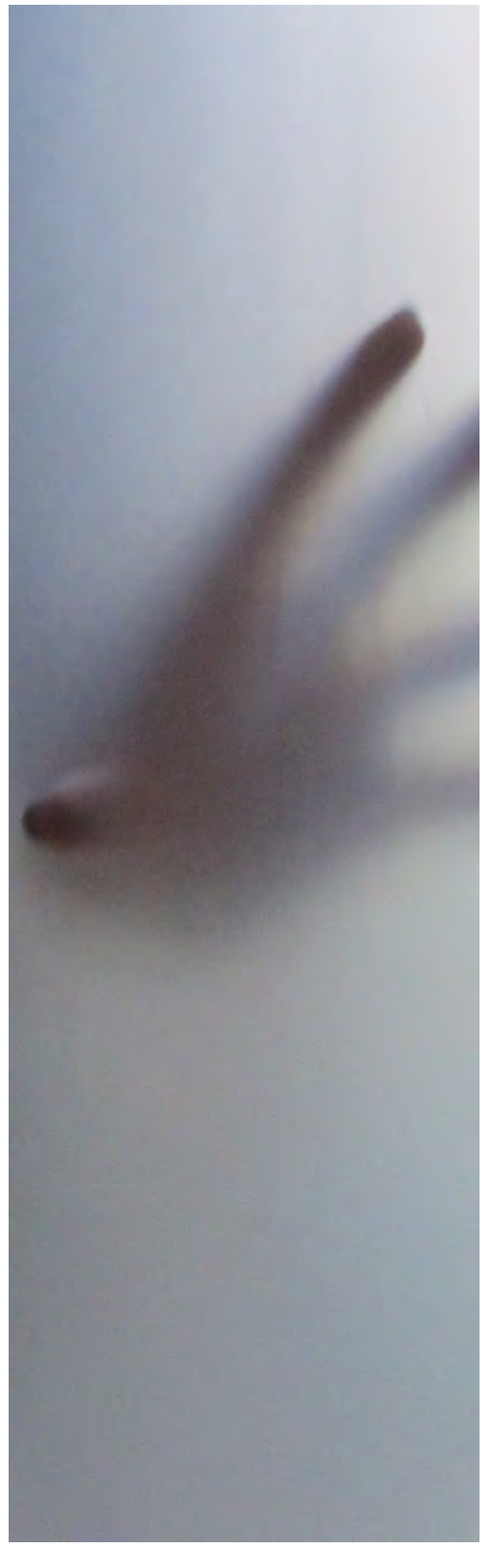


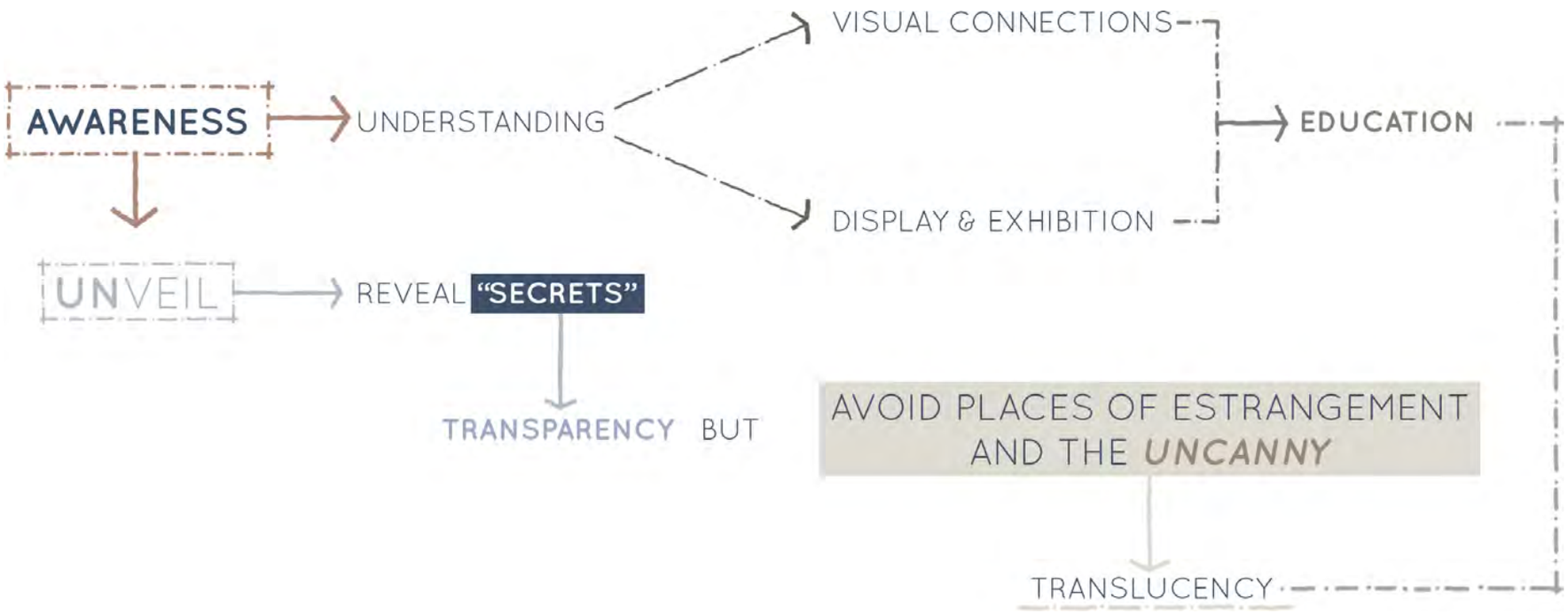
CONCLUSION: TOWARDS AN ARCHITECTURAL EXPRESSION

The sensitivity and importance of the work conducted in a microbiology laboratory should invoke a greater public awareness. It is through some sense of familiarity that understanding can be engendered. In terms of an architectural expression, this can be achieved through a visual connection concerning display and exhibition. In other words, the microbiology laboratory can take on an educational aspect that reaches beyond the scientists working inside of it.

When one considers notions of unveiling and revealing, especially as a visual metaphor, the idea of transparency seems an obvious solution. Nonetheless, as explained, in order to maintain a decree of balance; to prevent the laboratory being a place of estrangement, not all can be made completely transparent. Therefore, when in search of a visual connection somewhere between closed off and somewhere entirely transparent, it is translucency, rather, that may provide the medium. Translucency, as a design approach, neither clear nor opaque, can be used to draw an element of connecting with the public and the natural realm without compromising the functionality of the laboratory space.

It is through this connection to nature and its inevitable processes that the laboratory can become both scientifically and philosophically imbedded in balancing psychological tension. The ritual spaces of the scientist can be designed as places of interaction, meditation and contemplation, as examined with regard to the two precedents above, and interpreted as the places of the in-between that exist between man and the natural environment. These are the spaces that can be expressively experienced by the body, evoking expressions of hapticity. Architectural elements of the scientific institute, predominantly in these ritual spaces, can incorporate nature and relate to the notions of the ruin, as discussed previously. The scientific institute need not be independent from natural and experiential phenomenology; these experiences could cultivate the very creativity, complexity and communication needed for ground-breaking scientific innovation. By allowing portions of the design approach for such a scientific institute to directly involve the human body on an experiential level – where these primitive associations of ruin and ritual can be invigorated – the architecture itself can inspire these sought-after innovations.

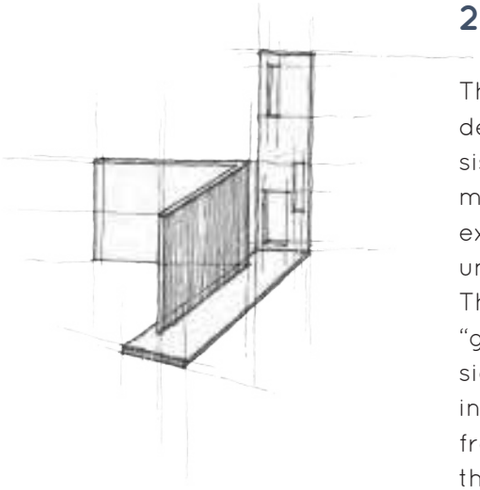




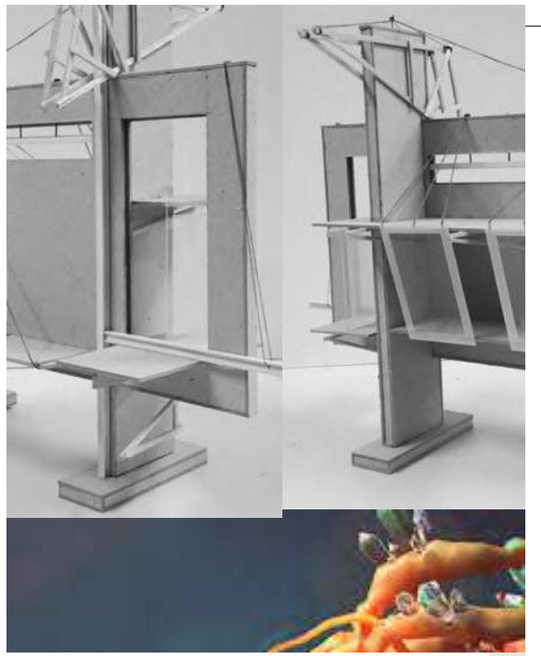
IMAGES (LEFT): A material which is considered translucent allows light to pass through to such an extent so that the object behind the material is distinguishable. However, enough light is refracted that the exact form of the object is not revealed. In other words, it becomes a medium by which the object or figure behind the material is revealed only to a certain degree; a sense of privacy is still maintained. In this way, curiosity and intrigue can in fact be heightened.
(Source: http://www.iaacblog.com/digital-fabrication/Translucent-polypropylene.jpg - accessed 3 July 2015).

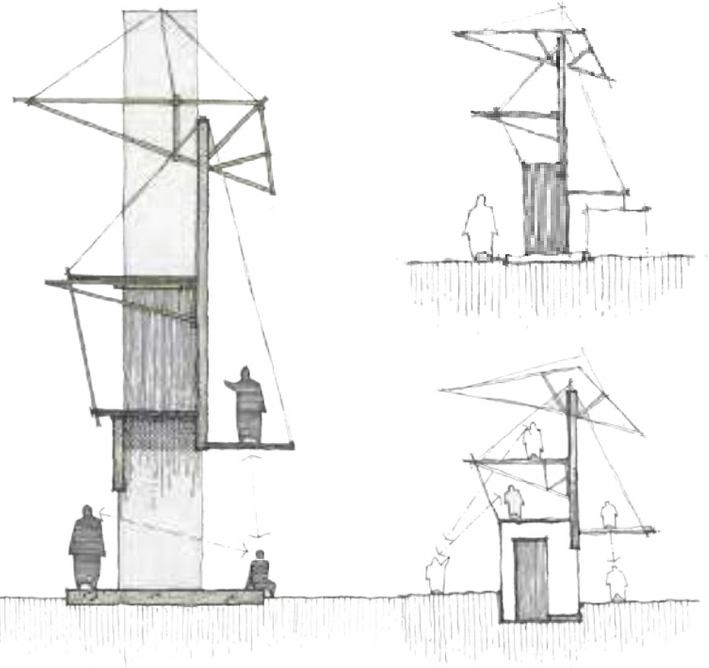
2.7 TECTONICS

2.7.1. STRUCTURAL CONCEPT EXPLORATION



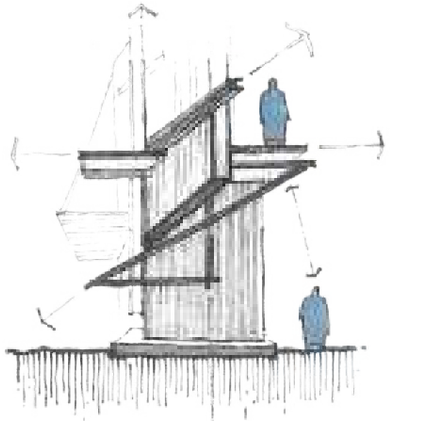
The initial structural concept was explored as a means of consolidating the three original design concepts and the ideas they involved. The buildings of the immediate context consist of load-bearing masonry and concrete, thereby implying the exploration of a stereotomic structure. Nonetheless, in terms of the explored morphological approach, the tectonic expression needs to include the notion of approaching the design of such an institute in a unique way. In other words, the structure needs to express some of the conceptual ideas. Therefore, arising from the stereotomic structure, lighter elements have been included to "grow" from this heavier, structural base. The intent is that the resultant structural expression allows for scientific observational activities on the interior, while allowing the scientist inside to also become an aspect of observation for those members of the public looking in from the outside... the observer becomes the observed; the scientific researcher becomes the specimen.

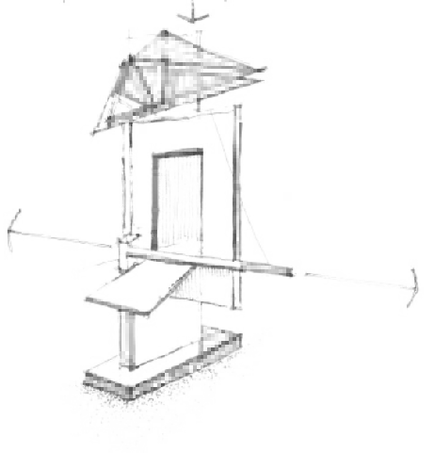


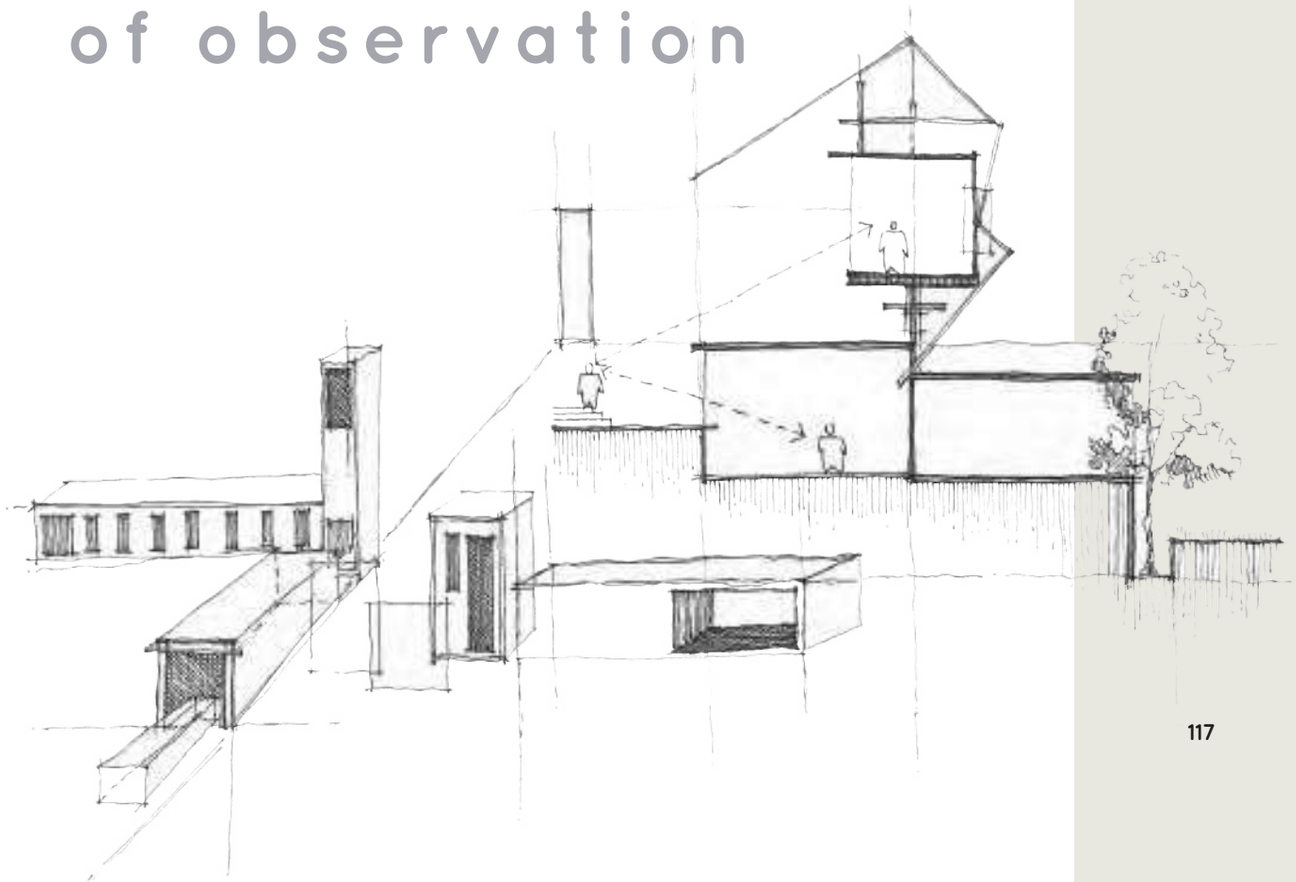


BECOMING THE SPECIMEN

of observation







2.7.2. TECHNICAL INVESTIGATION

2.7.2.1. OVERVIEW

The technical investigation is an essential part of the design resolution because it investigates the conditions of the proposed site, the different stereotomic and tectonic approaches to the structure itself, various components of the building, as well as aspects of sustainability involved in the proposed project. These are all indispensable facets of consideration in terms of achieving the final design resolution. The essential concept of the project is to use architecture as a means to reveal the influence of an *invisible realm*, which must be carried through to structural considerations.

2.7.2.2. THE SITE

An analysis of the proposed site is fundamental in determining an appropriate structural approach that will adhere to both contextual suitability as well as the intentions of the proposed project. Quantitative phenomenology will most likely determine the bulk of what will influence the structural approach, although qualitative phenomenological factors can also influence technical aspects of the project in terms of social and communicative characteristics.

CLIMATIC CONSIDERATIONS

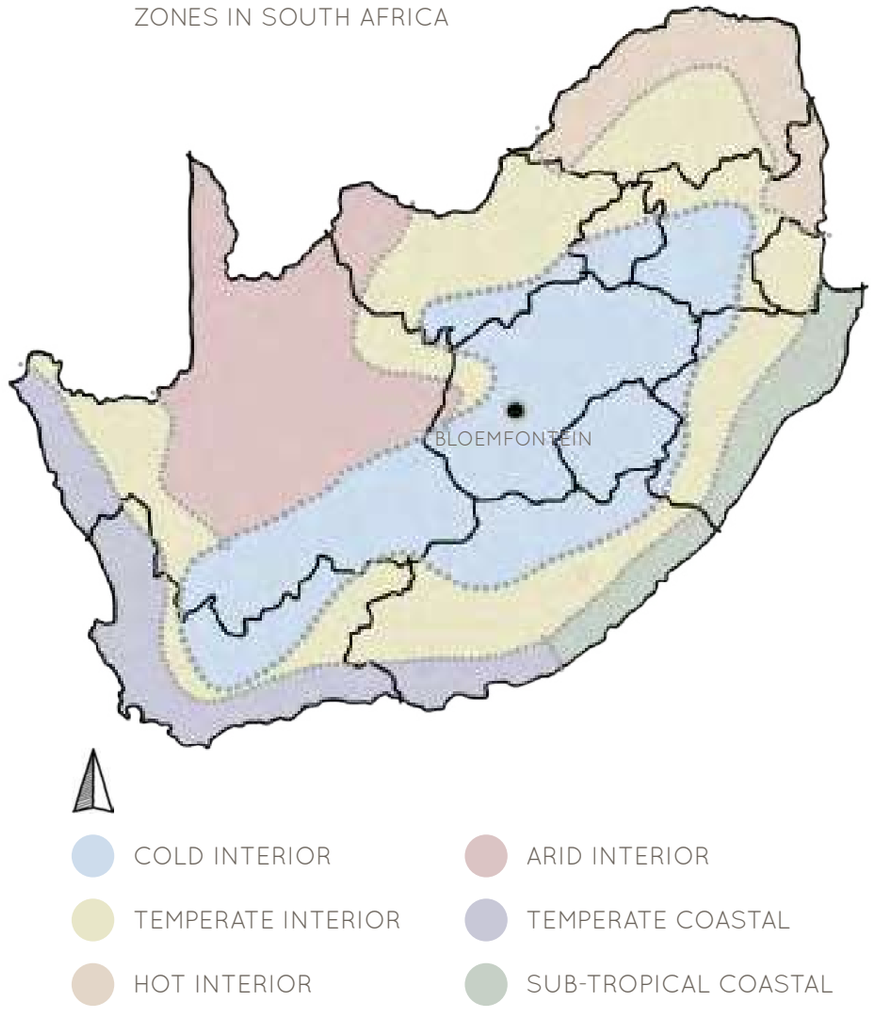
According to SANS 10400, Bloemfontein is located in Climate Zone 1, which can be described broadly as "cold interior". Climatic considerations greatly influence technical resolutions able to achieve both comfort and energy efficiency. Measures of energy intervention will vary across regions, and so the design of the building, the means of structural-assembly, and the choice of materials must suit the climatic region.

Bloemfontein can be described as semi-arid, implying that the rate of precipitation is slightly lower than the rate at which water evaporates from the ground-surface. This suggests that a facet of rainwater harvesting as a component of the structural resolution would be valuable. Bloemfontein experiences relatively hot summers (December-March), with an average daily temperature of 30°C, and relatively cold, dry winters (May-August), with an average daily temperature of 15°C.

The majority of Bloemfontein's annual rainfall occurs during the summer months, with the bulk in the months of January and February, although drought occurrences cause variation. Thunderstorms and cloudbursts are frequent during these months. Little rain falls in Bloemfontein's winter months, and snowfall is a rare event, although, because night-time temperatures often dip below 0°C, frost occurs regularly, both within the urban setting and outer farmsteads.

On average, Bloemfontein experiences a high annual mean of sunshine-hours (approximately 3300 hours per annum), indicating that solar energy and the manipulation thereof is a viable feature that can be incorporated in the technical resolution of the proposed project. This aspect is important for utilising this energy in an advantageous manner (energy production; exploiting natural light), as well as deterring sunlight to achieve thermal comfort within the building.

CLASSIFICATION OF CLIMATE ZONES IN SOUTH AFRICA



DESIGN RESPONSES SUITED TO CLIMATE ZONE 1

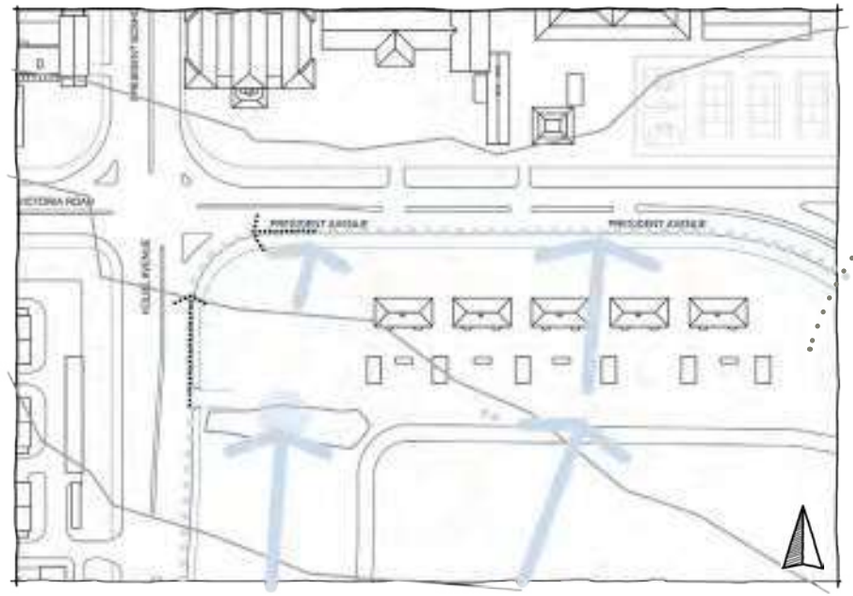
- Use of passive solar heating.
- Utilising high thermal mass.
- Effective insulation of the thermal mass, including slab edges.
- Maximise the north facing falls and glazing, especially in living areas.
- Minimise use of glazing on the east, west and south.
- Utilise adjustable shading.
- Use double glazing and insulating frames: glass must be well insulated for cold winters.
- Minimise the external wall areas on the east and west: orientate the building north.
- Use cross-ventilation and night-time cooling in summer.
- Seal building properly against draughts and provide airlocks at entrances.
- Reflective insulation can be used to keep out heat in summer.
- Bulk insulation can be used to maintain interior thermal comfort during winter.
- Walls, ceilings and floors should be bulk-insulated.

(Schmidt, 2013: 104-105).

TOPOGRAPHY AND SOIL CONDITIONS

The proposed site for this project is situated in Bloemfontein, located in central South Africa at an altitude of 1400 metres above sea-level. The area, on a macro-scale, is generally flat with a few hills (*koppies*) and the vegetation broadly consists of typical Highveld grasslands.

Soil in Bloemfontein and the immediate surrounding areas consists of sand, silt and clay. The texture of the soil is, on average, 65% sand, 10-12% silt, and a relatively high 15-25% clay (depending on the specific area). Bloemfontein and the surrounding southern Free State region is recognised for its high-clay-content soil and the distinguishing red tones that are a result thereof (Dingaan and Du Preez, 2013).

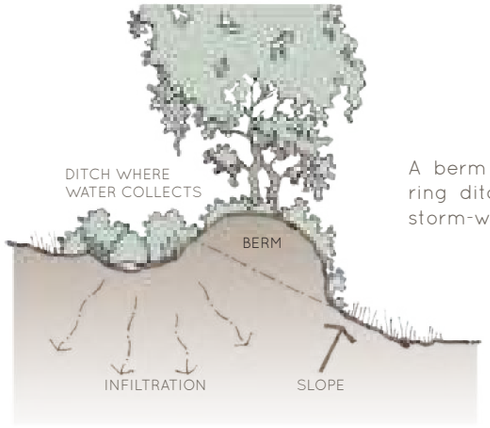


The topographical conditions on the micro-site affect the way that storm-water is drained from the site into the municipal connections. The blue arrows indicate this general flow, with the blue dot indicating the existing small ditch that can be utilised.

STORM-WATER AND THE MICRO SITE

The specific site was flattened when the existing structures were built. Because the site is bound by high-velocity vehicular traffic roadways on both the north and west, these sides of the site are serviced by municipal storm-water runoff drains.

The natural topography of the meso-site slopes from south to north. South of the site, slightly to one side, is a manicured and landscaped golf course that prevents storm-water collection on the site because the lawns and man-made ponds assist in soaking up and collecting this runoff. To the south-east, where the golf course ends, is a cleared area for what used to be a bowls lawn. This part of the site still slopes towards the north, with an overall slope of 2-3 meters. Nonetheless, because of the flattening of the site for the existing structures, with the sloping natural topography of the unpaved areas, a ditch is created on the southern side of the side where runoff collects. The result is the creation of a micro-climate, where vegetation thrives due to the excess water. Trees that normally require a lot of water, such as willows (non-indigenous), are able to flourish amongst the indigenous vegetation, such as the yellow-thorn acacias. This ditch, with the abundance of vegetation to absorb excess water, assists in preventing excessive storm-water from flowing across the site.



A berm can be created around the occurring ditch on the site that may assist with storm-water control.

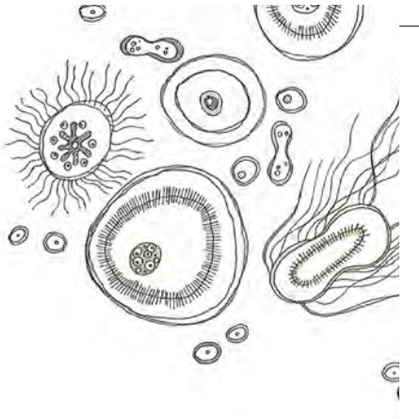
STRUCTURES SEEN WITHIN THE CONTEXT

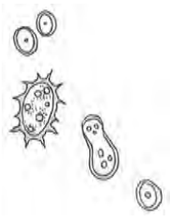
The structures within the context are predominantly stereotomic, consisting of modernist multi-storey apartment buildings of concrete frames with brick infill; small-scale red-brick residences with corrugated-iron pitched roofs; and more historic neoclassical institutional buildings that have been plastered and painted, with clay tile roof coverings. Therefore, different structural approaches were employed to achieve the various architectural styles that are present within the context, highlighting the emphasis that structure has in terms of communicating visually with the public.

THE NEOCLASSICAL INSTITUTION

THE CLAY-BRICK RESIDENCE

THE CONCRETE-FRAME APARTMENT BLOCK

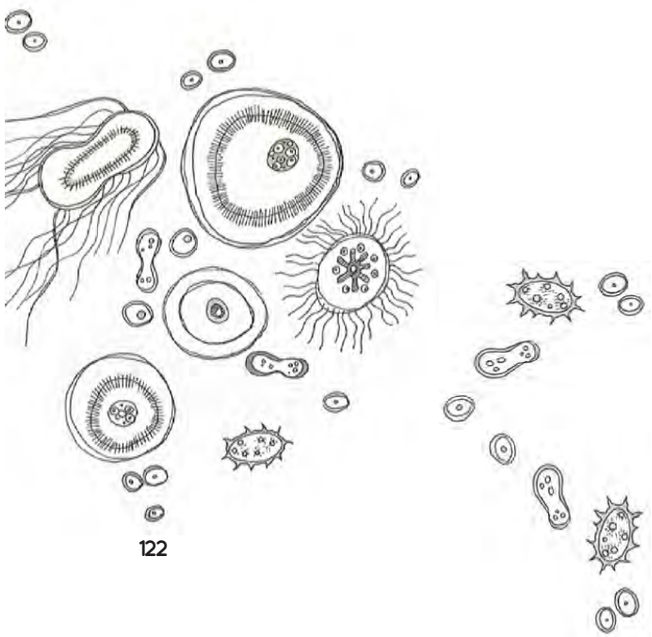


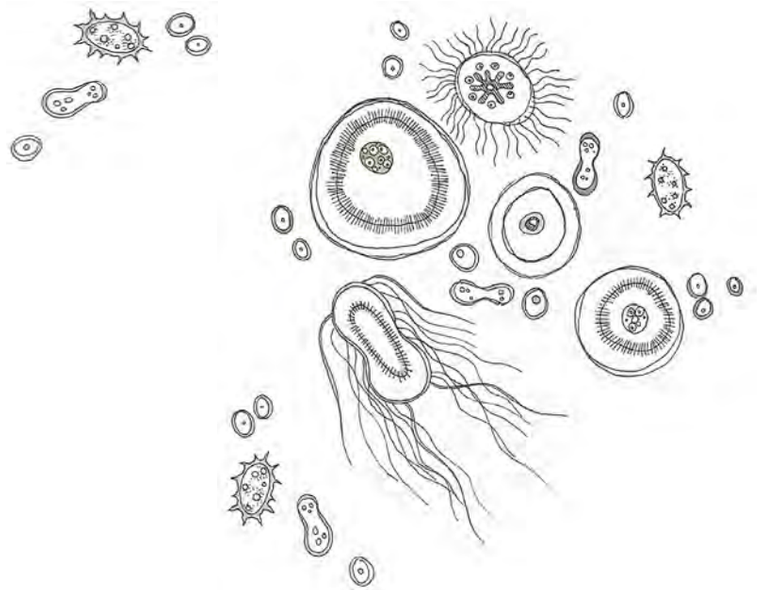


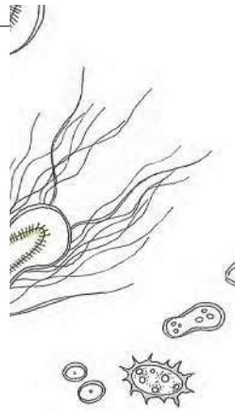
2.7.2.3. UNIQUE REQUIREMENTS FOR MICROBIOLOGY LABORATORIES

Microbiology laboratories have special requirements due to the nature of work and the materials handled within them. Microorganisms are invisible; some are airborne; can be transported on surfaces or on human beings; and can grow into large populations – they are live, active entities. Therefore, not only do these laboratories have to provide the conditions conducive to microbiological growth, but techniques to manage these areas must also be developed.

Precautionary measures are essential for preventing the release of high microbial populations into the environment or other aseptic spaces within the laboratory complex. Ultimately, the physical separation of many spaces by means of barriers is essential in achieving this level of control (LabNetwork, 2009: online). Research laboratories are specialised workplaces for conducting scientific research. Contemporary laboratory design is moving in a direction that responds to both current and future needs, encourages interdisciplinary action among scientists, and enables partnership and development with an ode to social responsibility.



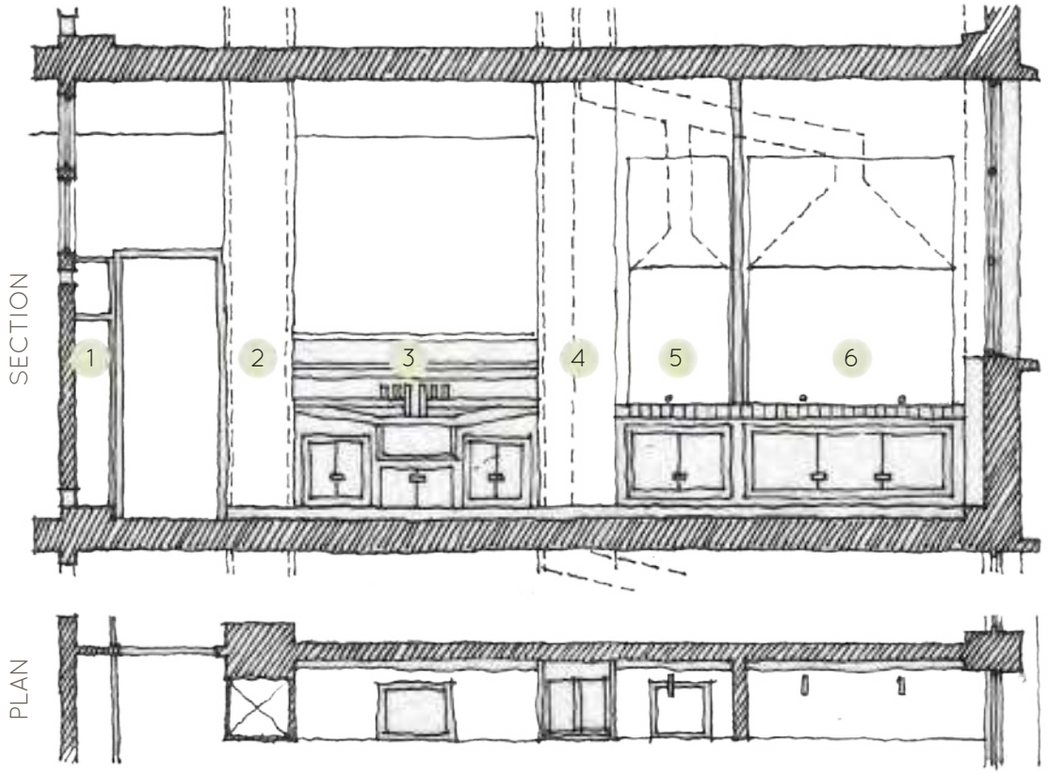




THE BASIC PHYSICAL INFRASTRUCTURE REQUIRED FOR A MICROBIOLOGY TESTING LABORATORY

IDENTITY	SPACE REQUIRED	FUNCTION	SPECIFIC REQUIREMENTS
Testing laboratory.	30-50m^2	Testing samples.	Temperature and humidity control; air-quality control; house testing equipment; floor and bench surfaces cleaned daily.
Media preparation room.	15-25m^2	Preparation of microbiological media and storage.	House preparation equipment and provide storage for unused microbiological media.
Incubator room.	15-25m^2	House incubators.	Temperature must be maintained below 33°C; house incubators operating between 10-45°C.
Reference culture room.	10m^2	Maintaining reference cultures.	Temperature and humidity control; microbiological quality of air must be maintained; house lamina hood and refrigerator; floor and bench surfaces cleaned after each use.
Decontamination room.	15-25m^2	Washing and decontaminating glassware.	House washing and decontaminating equipment; cleaned on a daily basis; used test materials after decontamination must be disposed of daily.
Sample receipt room.	15-25m^2	Temporary storage.	Conveniently located for access away from testing laboratories with a refrigerator and freezer.
Tested sample store.	15-25m^2	Temporary storage.	Located away from testing facilities with a refrigerator and freezer.
Store room for purchased media.	10m^2	Permanent storage.	Temperatures controlled to 15°C.
Office.	15-25m^2	General administration.	Handling of all documents; communication and printing facilities; safety lockers for test reports and confidential documents.
Microbiologist.	15-25m^2	Office.	Room for the technical manager with visibility to testing laboratories with transparent partitioning.
Staff room.	20-35m^2	Office.	Room for staff to rest and carry on with duties when not engaged in bench work.
Cleaning equipment.	5m^2	Storage.	Space to keep cleaning equipment for the laboratories.
Changing room.	10-15m^2	Laboratory clothes.	On the passage to the testing laboratories.
Wash room.	15-20m^2	Room for personal hygiene.	Separate female and male facilities at a ratio of 1 unit per 8 staff members.

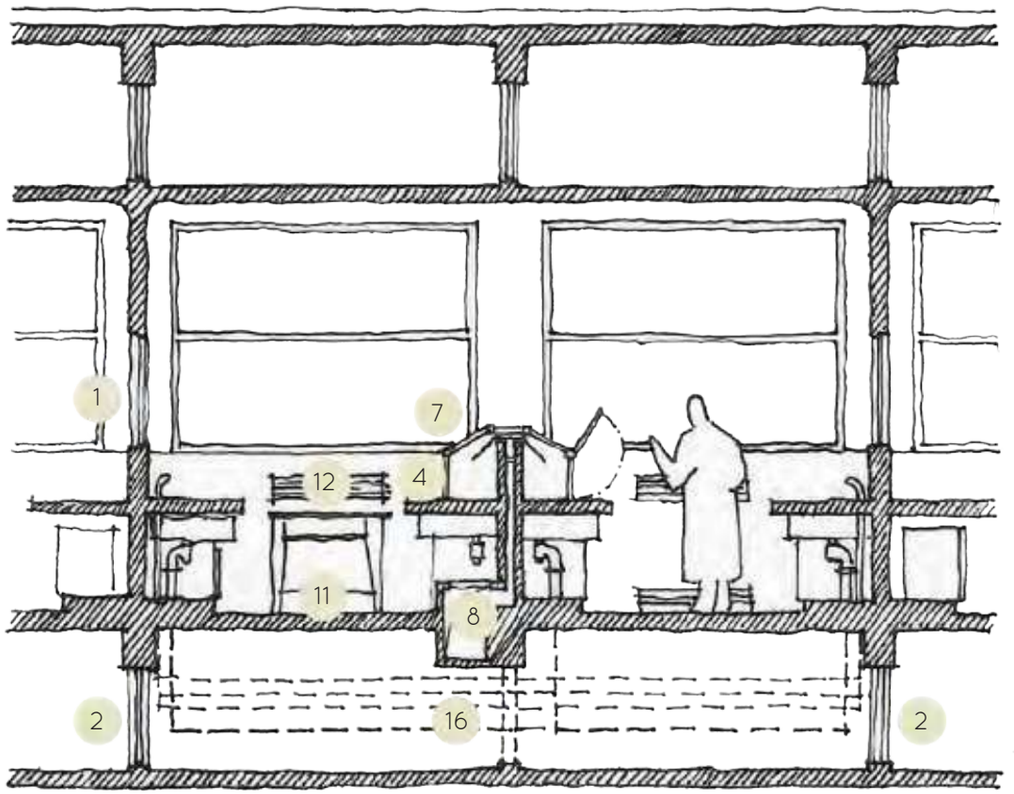
1. CUPBOARDS
2. SERVICE DUCT
3. SINK
4. FLUES
5. STEAM HOOD
6. FUME CUPBOARD



Cross-section and plan through typical microbiology laboratory with ancillary services.

By producing a well-designed laboratory planning module, architectural and engineering considerations can be consolidated. The module can provide flexibility, and encourage change and development within the building. Because research and the associated techniques thereof are developing in association with current trends in technology, research facilities need to be capable of reasonable change. A module also allows for expansion, and enables the building to adapt to growth without disturbing the functionality of the facility.

1. GLASS WALL
2. GYPSUM PARTITION
4. LABORATORY TABLE
7. FUME CUPBOARD
8. WASTE DUCT
11. AIR EXTRACTOR
12. WARM AIR OUTLET
16. WASTE PIPE



Longitudinal section through typical microbiology laboratory showing ancillary services and underfloor service duct.

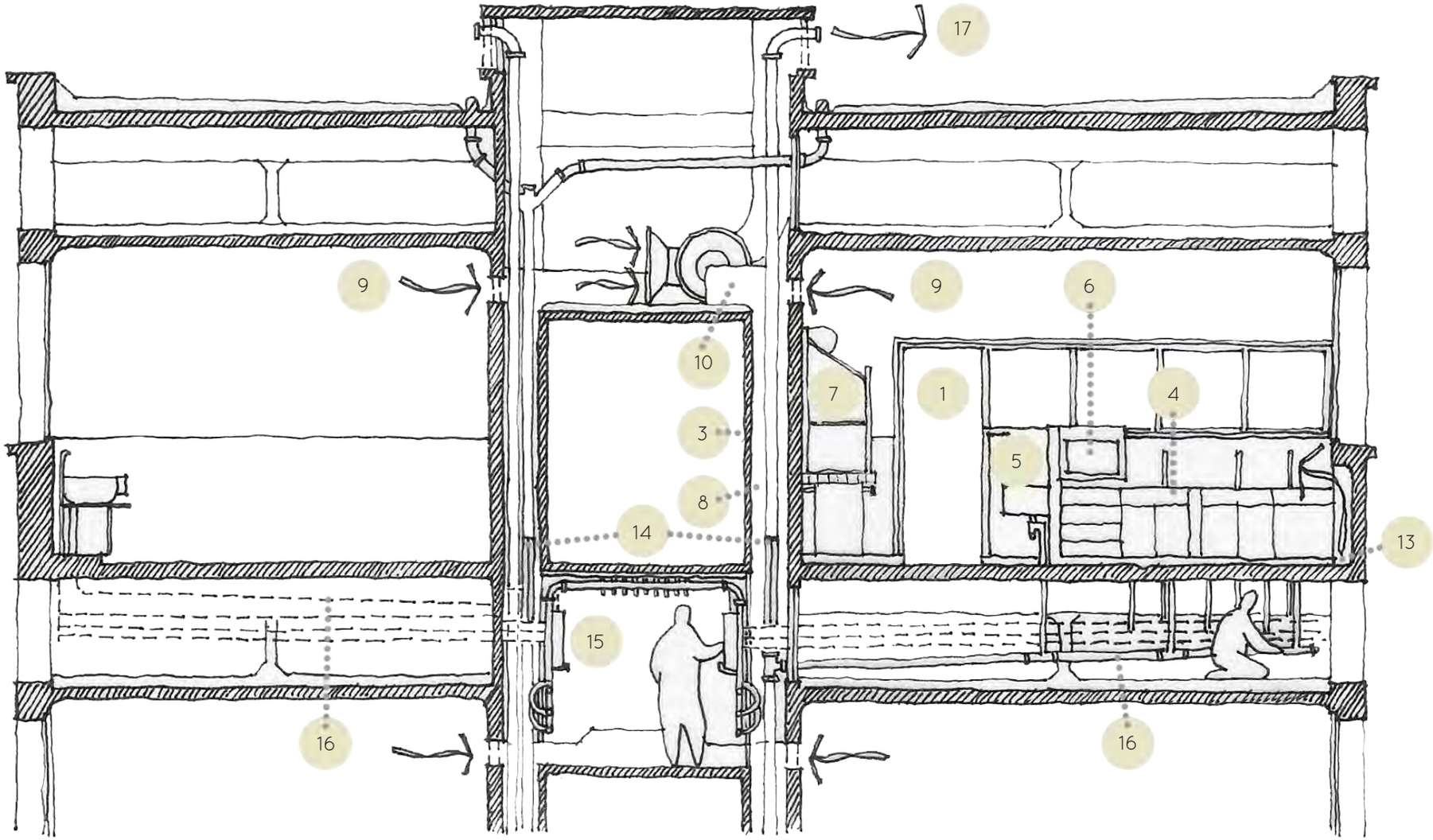
The relationship between the laboratories, offices and circulation corridors impacts significantly on the operational functionality of the building. The planning concepts of these spaces will dramatically affect whether or not they are actually functional for their purpose. Natural light, for instance, as much as it is an architectural design tool, is not always suitable for some types of research spaces and may negatively impact the kind of work that needs to be conducted. Specialised instruments, such as nuclear magnetic resonance (NMR) apparatus and electron microscopes cannot function properly in natural light. Vivarium facilities and support and communication spaces also function better without an influx of natural light, so they would be better located in the central interior of the building. Furthermore, by dividing the building facilities between those for laboratory use and non-laboratory use, costs can be reduced, as services and requirements can be grouped. Laboratories require complete outside (fresh) air, while non-laboratory spaces can use recirculated air.

When designing laboratories, the foundation of their planning is the nature and equipment of the individual working area. Consideration must be paid to lighting, solar heat, space heating, ventilation, position and type of fume cupboards, and provision of gas, electricity, water and drainage services. Since modern measurement techniques use radioactive indicators, radiation protection is also necessary. The detailed dimensions of the working area are determined by the physical reach of the individuals who work in the labs, as well as the sizes of the tiles that cover surfaces. Wall benches and double work benches are normally constructed of rolled steel sections with a concrete slab finish, with the services (gas, water, drainage, vacuum, and electricity) housed underneath. Island benches are relatively uncommon since wall benches are more orderly and can provide services without the need to introduce floor ducts. In framed buildings, it is better to take the service duct through corridor walls. It is important that all services are insulated against condensation, heat, cold and noise, and to protect against vibrations (Neufert, 1970: 180).

An accessible roof structure should be provided to accommodate a ventilation plant above the upper laboratory storey, particularly for flat-roof construction. A mezzanine crawl duct can be incorporated above laboratories and walkways over corridors. Floors should be impervious, resistant to chemical abrasion, colourfast, easy to clean, not too cold, and must possess a low electrical conductivity. Joints, which will collect dirt, should be kept to a minimum. A floor made of many parts is best, as damaged and contaminated areas can be removed and replaced (Neufert, 1970: 181).

The fume room is divided from the rest of the laboratory by glass walls and sliding windows for work involving large amounts of gas, odour and other fumes. The size of the fume cupboard depends on that of the main laboratory – it should be proportional. It must also be lit from above and outside so that fittings are not damaged by the gases, and fittings should preferably be remote-controlled (Neufert, 1970: 181).

A weighing table is also a feature of every laboratory, and is usually housed in its own room. The size of this room depends on the nature of scales, the sets of weights and materials that will have to be weighed. Conventionally, the size of such a room is 1200 x 750mm. The table itself consists of two independent parts; one for the scales and weights, and the other for the material to be weighed. These tables always stand against particularly thick and shockproof walls (Neufert, 1970: 181).

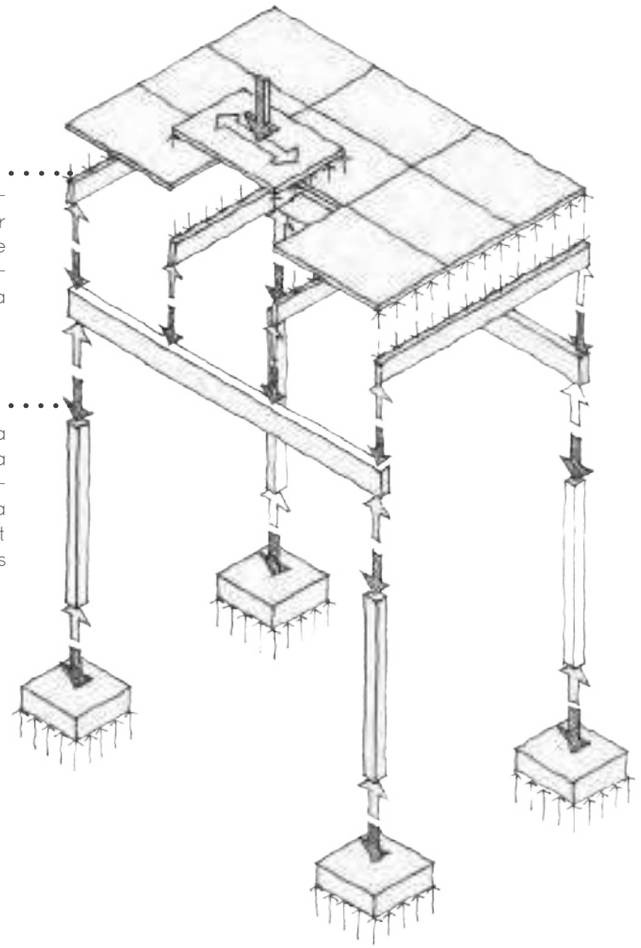


1. GLASS WALL
2. GYPSUM PARTITION
3. REMOVABLE CLADDING
4. LABORATORY TABLE
5. DRAIN BOARD
6. BENCH
7. FUME CUPBOARD
8. WASTE DUCT
9. USED AIR
10. USED AIR VENT
11. AIR EXTRACTOR
12. WARM AIR OUTLET
13. CONVECTOR HEAT
14. STOP COCK
15. E. D. BOARD
16. WASTE PIPE
17. VENTILATION PIPE

Cross section through typical microbiology laboratory showing ancillary services and required service shafts.

UNIFORM LOAD: Loads of uniform magnitude extending over the length or area of the supporting structural element as in the case of a live load on a floor deck.

CONCENTRATED LOAD: Acts on a very small area or particular point of a supporting structural element, such as when a beam bears on a post or a column bears on its footing.



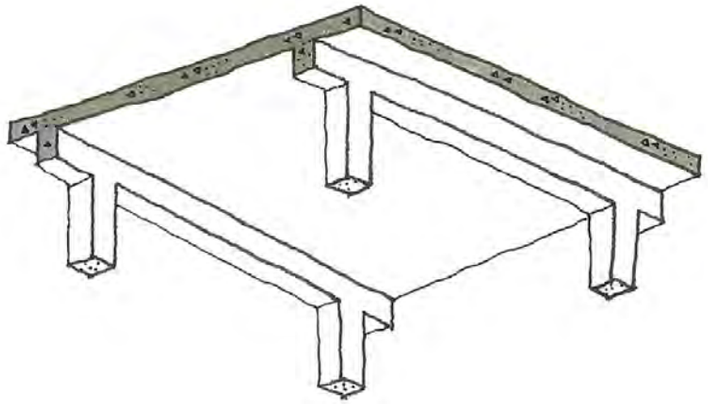
2.7.2.4. LABORATORY STRUCTURE: A CONCRETE FRAMEWORK

COLUMN AND BEAM SYSTEM

Because of some of the more specialised services required for a laboratory research building, a stereotomic monolithic structure would be more appropriate. The likes of fume cupboards, refrigerators and incubating rooms all require solid insulating walls to work effectively. Furthermore, when considering the construction of these services, especially the ventilation shafts required for fume cupboards, it is more effective to stack them on top of one another. In other words, it would work better to stack two laboratory floors on top of one another so that the two adjoined fume cupboards can share a ventilation shaft. In general, research laboratories require privacy for conducting scientific work. Taking both of these factors into consideration, a system of steel-reinforced concrete columns and beams will be utilised. In this way, the compressive strength of concrete is combined with the tensile strength of steel to create a skeleton for the laboratories. Because a skeleton system with infill will be utilised for this component of the project, the principle of equilibrium must be adhered to. Therefore, the different spans of concrete building components will have to be remembered, which affects the use of precast concrete elements and those cast on site.

IMPORTANT ASPECTS FOR THE CONCRETE STRUCTURE

A regular grid of mostly 3,6x4,2m is utilised, as this suits the requirements of conventional research laboratory spaces (Neufert, 1970: 321). On this grid, 250x250mm steel reinforced concrete columns are cast in place, with 250x450mm deep concrete beams cast overhead. These form the primary structural system, on which a 170mm thick steel reinforced concrete floor slab is cast to rest on the beams. Because of the regular nature of the grid used, a one-way spanning slab is used over the parallel beams.



A ONE-WAY CONCRETE SLAB AS VIEWED FROM THE UNDERSIDE OF THE FLOOR SOFFIT.

ADVANTAGES OF THE ONE-WAY CONCRETE SLAB

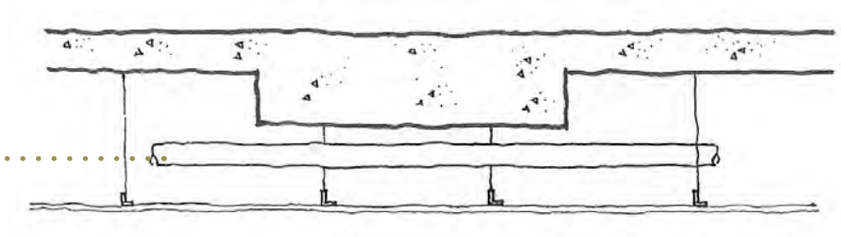
(RELATIVE TO OTHER CONCRETE FLOOR SYSTEMS)

- Fire resistance.
- Sound attenuation of the floor and resistance to flanking transmission between rooms.
- Ease of accommodating service openings.
- Ease of accommodating horizontal services distribution close to the slab soffit.
- Ease of making fixings to the slab soffit for suspended ceilings, services, etc.
- Ease of fixing heads of partitions to the slab soffit.
- Ease and speed of constructing the slab.
- Ease with which perimeter cladding support details may be accommodated.

(Concrete Society, 1986: 37)

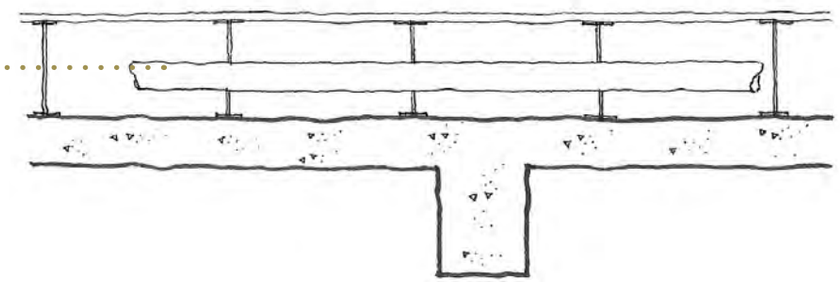
IMPORTANT ASPECTS FOR THE CONCRETE STRUCTURE

Utilsing wide but shallow beams (where required) avoids the problem of having to penetrate beams for services.

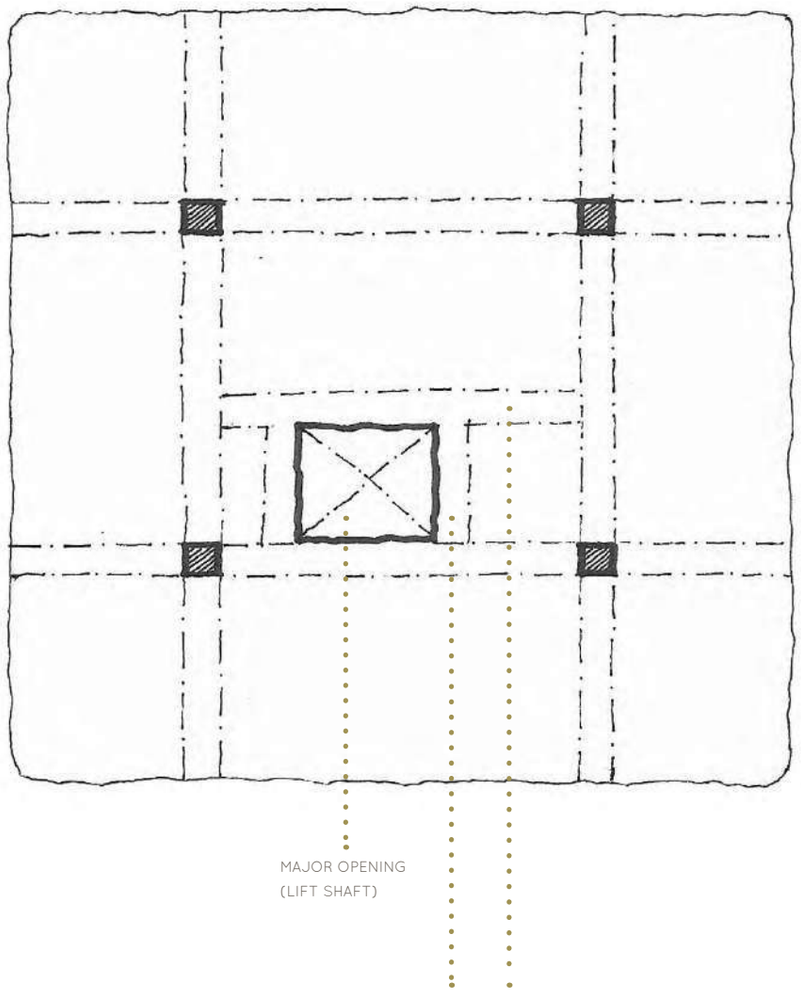


A suspended ceiling allows the service run to be hidden in the void between the ceiling the and the concrete structure.

A suspended floor allows for both the service run, and the easy replacement of a section of floor if damage occurs.



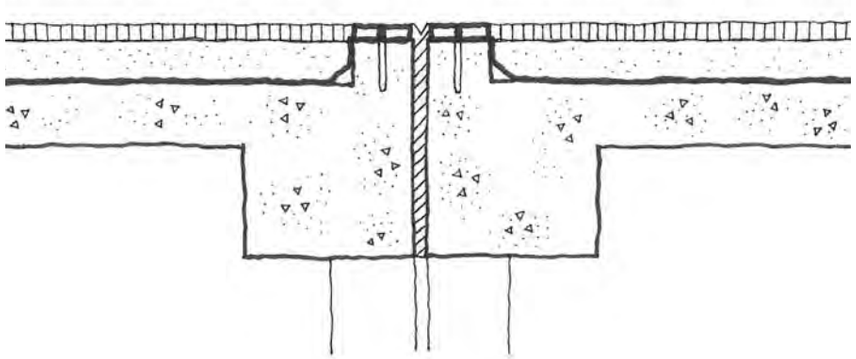
A raised floor allows for underfloor services to be provided without compromising the structural integrity of the concrete system.

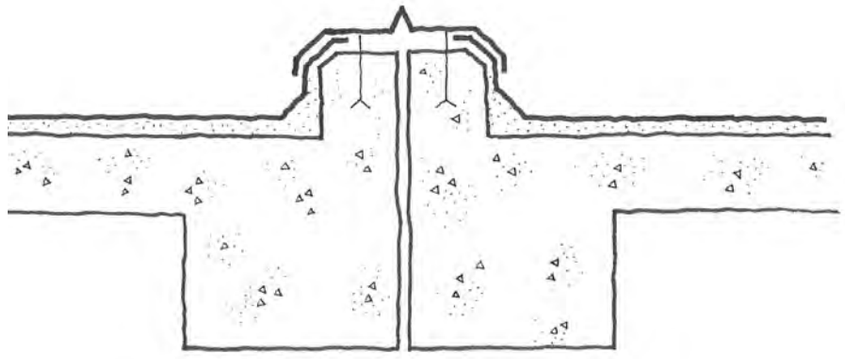


Major openings are intrinsic to the structural design, be it for the elevator shaft, stairway, or shafts required for the service ducts. Trimming beams will be required around openings.

CONSTRUCTION, MOVEMENT, AND EXPANSION: THE JOINT

Concrete is subject to volume changes due its characteristics with regard to moisture and temperature. To relieve the tensile and compressive stresses on volumes of concrete, planned construction, isolation and expansion joints are induced. A bond is also required at these joints, between two successive placements of concrete, normally in the form of a thermoplastic sealant.

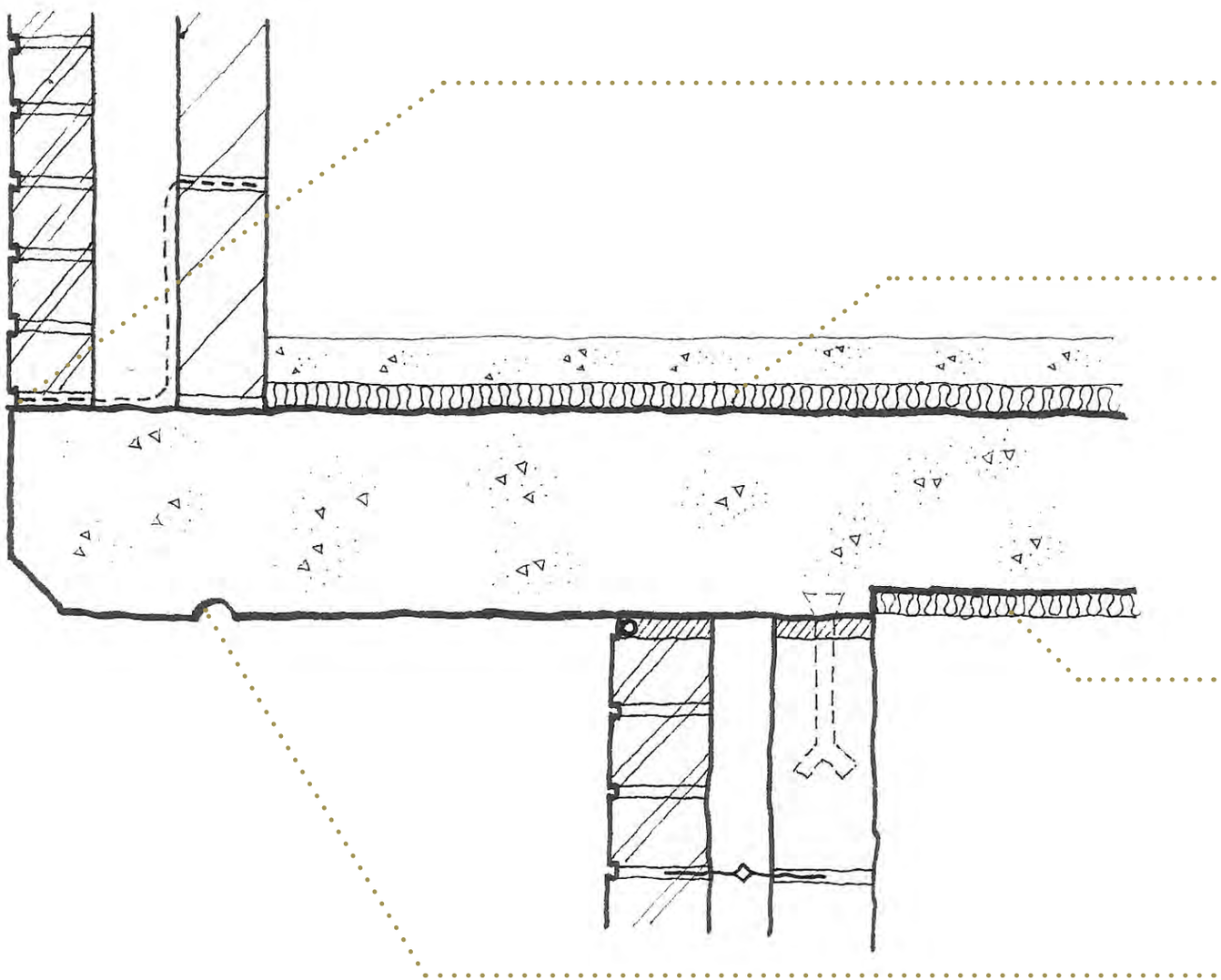




A joint between split columns (above) is preferred to a 'halved joint' for movement joints within the structural envelope, which requires more complex detailing and construction. The joint filler material needs to have suitable compressibility

"Concrete" texture source: http://freestocktextures.com/texture/id/763 - accessed 9 September 2015.

IMPORTANT ASPECTS FOR THE CONCRETE STRUCTURE - THE ROOF OVERHANG // PARAPET WALL



Insulation for cold-bridging under the screed will require an extra thickness of screed to accommodate it. A light mesh reinforcement should also be considered where the insulation stops (at the transition point) to prevent cracking.

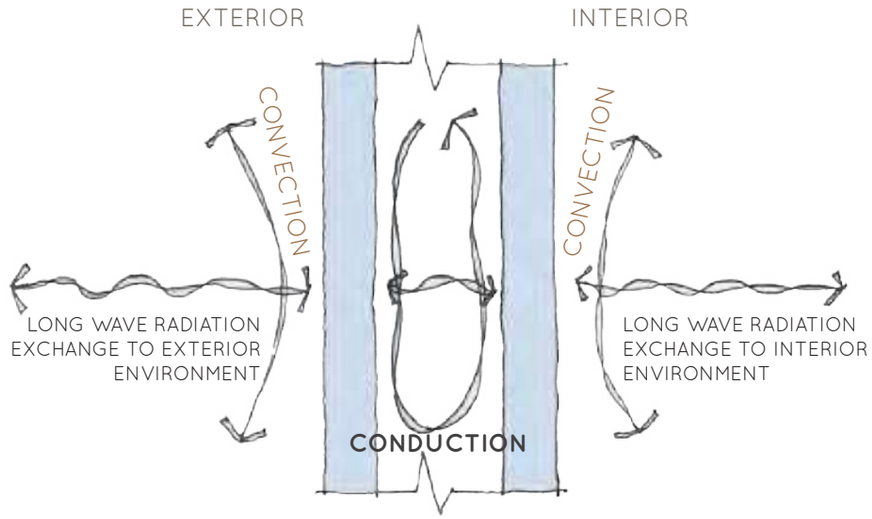
A vapour barrier can be utilised to prevent condensation.

A drip must be present to prevent water running along the soffit.

OPENINGS AND GLAZING

When sunlight strikes a pane of glass, the rays can either be reflected, absorbed, or transmitted. This is known as the performance of the glass and is predominantly affected by the type of glass and glazing system utilised. These three factors are always present when light hits a surface of glass, and in conjunction, make up the energy count for the opening that the particular piece of glass in question covers. Heat flows through a window by means of conduction, convection and radiation. Conduction occurs through the solid material and refers to the movement of heat from the warmest air to the coolest air – the difference between indoor and outdoor temperatures. Convection occurs through air spaces, and refers to the air that passes over the surface of the glass – if it is cooler than the glass and frame, it will take heat away from it, and if it is warmer it will heat it up. Radiation occurs between the glass surfaces on either side of the air gap and is transmitted as long electromagnetic waves (Schmidt, 2013: 254).

The capacity of a window assembly to resist heat transfer is referred to as its insulating value. The main principle is to control heat loss, especially in colder climates. Heat always flows from the warmer to the cooler side of the window assembly. A glass curtain wall system consisting of double-glazed safety glass that hangs from the structural concrete frame can be utilised. In other words, openings are not limited to being holes merely cut out of solids where this is not required. Nonetheless, the building stills needs to meet the SANS 10400 requirements, which state that fenestration must be within 15% of the floor area of particular space, otherwise the fenestration will have to be calculated by means of rational design.



The above diagram illustrates the flow of heat through a window and how a cavity-element between the two glass panes assists in creating an insulating air gap that deters the loss of heat.

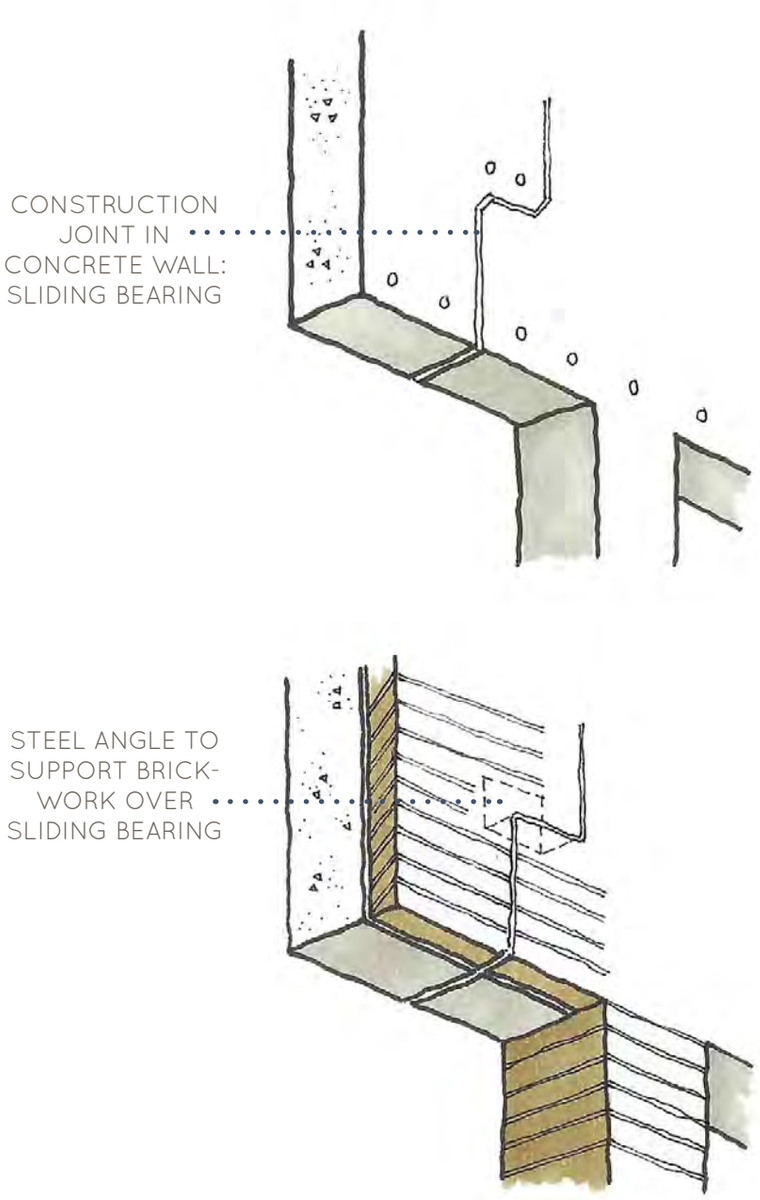
"Polycarbonate" texture source: http://www.everliteconcept.com/media/k2 - accessed 9 September 2015.

In order to communicate the concept of translucency through the structure, polycarbonate and polypropylene glazing systems can also be utilised. Furthermore, these materials are also conducive to greenhouse construction, to be included in the community gardens and nutritional research structures.

MASONRY WORK: AN INSULATING AND VERNACULAR INFILL

As infill for the concrete slab and beam system, masonry has been chosen as the primary solution for its insulating properties and its adherence to the context, which consists mostly of red-clay-brick buildings. Furthermore, clay masonry has a good resistance to fire, which is beneficial considering the fire risk of such a building that is suited to laboratory work, and considering some of the equipment required in these spaces. The clay-brick masonry will not be constructed in a conventional load-bearing manner, but rather, options of creating the building envelope of brick supported by the concrete frame are explored. Masonry can be used as a system of creating the building envelope around the concrete frame in other spaces that do not require the walls to be a structural component of their own. Additionally, the system that comprises the masonry envelope has an insulating component, to assist in maintaining the thermal mass of the building.

In brickwork cladding there is differential movement as bricks expand and the concrete frame shrinks. Where there are long lengths of wall between columns, movement joints will be necessary (9m centre to centre), even on the inner skin. Face brick and block work is tied to the columns using fishtail ties. In long runs of brick these ties may cause cracking, thus more flexible double-triangle wire ties would be more suitable.



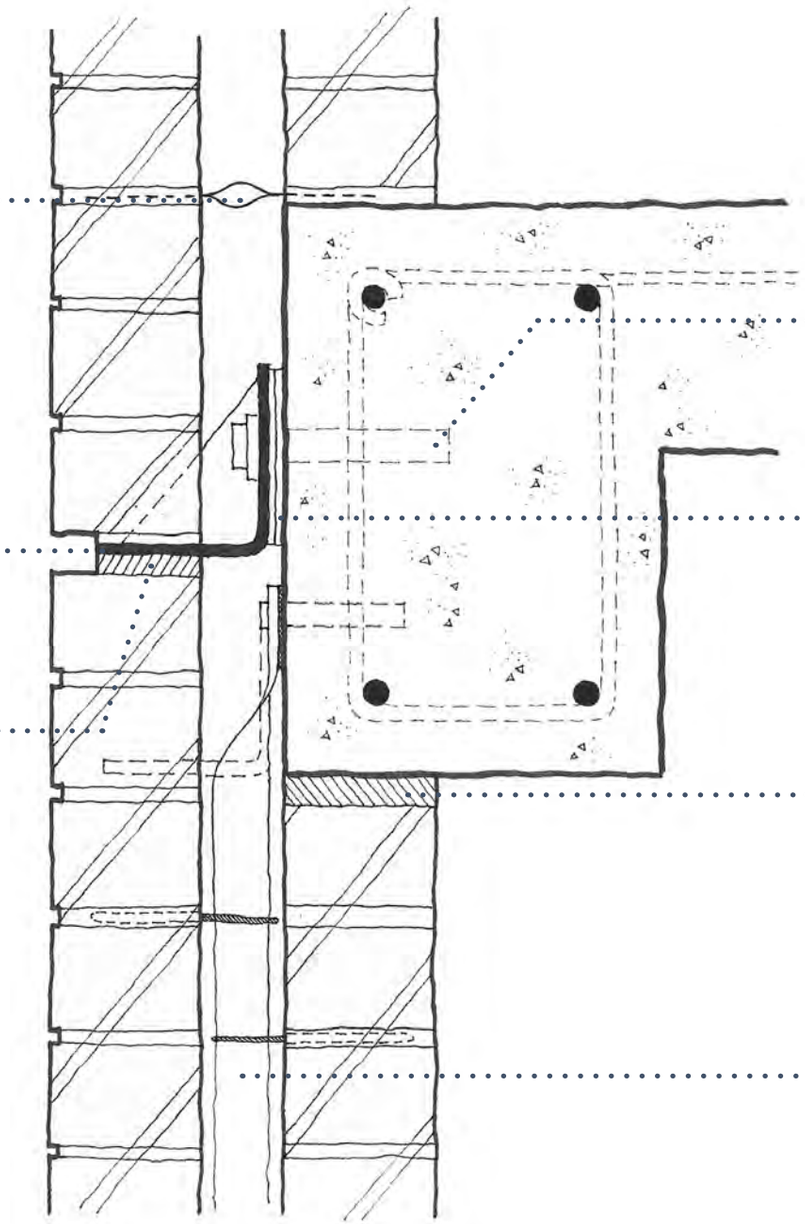
IMAGES (RIGHT): It is important that the movement joints should pass right through the structure, cladding and finishes. Cladding and partitions should be detailed to accommodate for the movement of the concrete frame and allow for deflection.

Ties should be located as close as possible to the angle in order to restrain the outer leave.

SUPPORT OF MASONRY ON STAINLESS STEEL ANGLE

Angle must support at least two thirds of the outer leaf thickness.

Differential movement joint of compressible filler (10-15mm thick).



BRICK CLADDING ON THE CONCRETE STRUCTURE:

Drilled fixing located to miss the main reinforcement.

Large horseshow washer to allow for variations in the face of the concrete. The angle requires a firm backing at its fixings.

A movement gap is required for the inner skin built of brick.

A patent stability tie is required to provide lateral support for the wall.

"Brick" texture source: http://freestocktextures.com/texture/id/180 - accessed 9 September 2015.

THE IMPORTANCE OF INSULATION

Effective insulation is one of the most critical parameters when designing the building envelope, and should be considered all way down to the foundation level. Insulation needs to cater for seasonal variations in terms of both temperature and levels of moisture present throughout the year. It is important to note that effective insulation for a building must be used in conjunction with other passive design principles. For instance, if thermal insulation is used without the use of shading devices over openings or effective cross-ventilation, then the interior could heat up to a level that is uncomfortable to those who have to inhabit the building. Insulation also assists with weatherproofing a building, as it reduces condensation, and provides sound proofing, due to its inherent qualities. It is most economical to install insulation during construction (Schmidt, 2013: 115).

Insulation impacts the surface temperature of the envelope interior, which directly impacts the thermal comfort. Interior envelope surface temperatures must remain high enough during winter to avoid condensation and maintain occupant comfort. To achieve consistent thermal insulation of the building envelope, assemblies must be carefully detailed with continuous thermal breaks. This will significantly increase the building's thermal performance. The National Building Regulations state that proper insulation in the areas that affect the building's thermal performance most is necessary to meet requirements in terms of SANS 10400-XA. These areas include roofs and ceilings, veranda roofs, external walls, and floors (Schmidt, 2013: 116).

PERIMETER INSULATION OF CAVITY WALL:

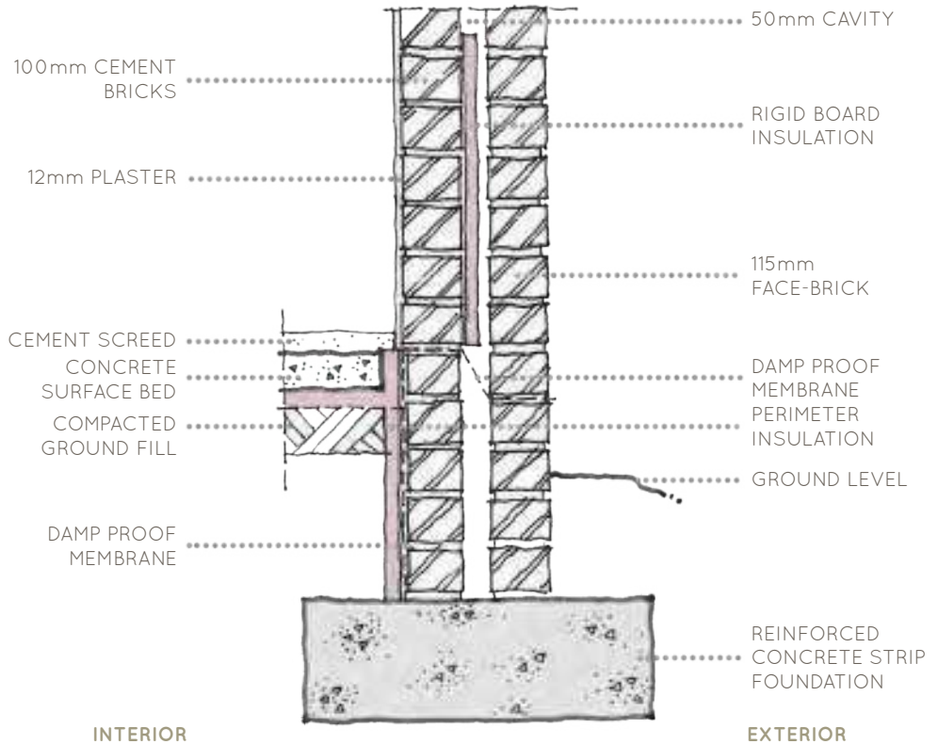
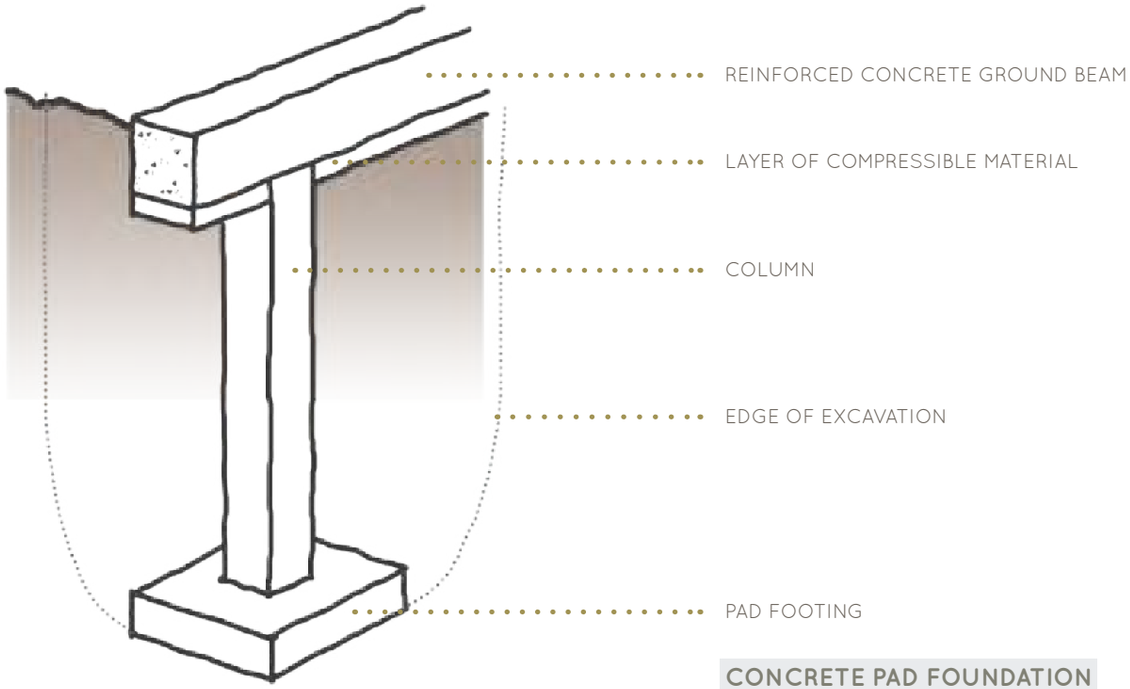


IMAGE (TOP): The diagram above illustrates the combination of cavity wall insulation with perimeter insulation and underfloor insulation at foundation level. This implies that the building envelope is effectively sealed from the outside, taking additional roof and opening insulation into consideration, and means that ventilation and thermal mass can be effectively controlled through purposeful design considerations.

"Ground" texture source: http://freestocktextures.com/texture/id/594 - accessed 9 September 2015.

SUBSTRUCTURE: FOUNDATION SYSTEM

Pad foundations are used to support individual point loads, such as structural columns. Briefly, a pad foundation consists as “pieces” of strip footing and a slab, usually of uniform thickness. Pad foundations are usually shallow, but can be adjusted to suit deeper foundation systems. Considering the clay ratio in the soil on site, the foundations of adjacent columns can be combined to create a larger footing of a continuous strip. This will allow for a heavier building load without gradual sinking into the clay, much like a raft foundation. The centre of gravity between each column becomes important when calculating how the columns should be spread on the rectangular footing, influenced by the column that carries a heavier load. The primary role of the foundation is to transfer all the loads of the superstructure to the ground. The type of superstructure and its combined loads affect the foundation design as much as the soil conditions do (Schmidt, 2013: 196).



CONCRETE PAD FOUNDATION

2.8 Towards a DESIGN METHODOLOGY

Through the process of exploration thus far been undertaken, certain lessons could be applied to the design synthesis to follow. The touchstone opened up a way of thinking about this microbial world, and suggested ways that a form of understanding can be engendered by realising that the architecture can become an intermediate tool of communication. Through a process of interaction and visual display, the world of microorganisms can be revealed and related to better. From there, the formative conceptual ideas were able to begin pointing out a means of approaching a design on this specific site, especially in terms of the kind of scales and proportions that would be suitable in the context.

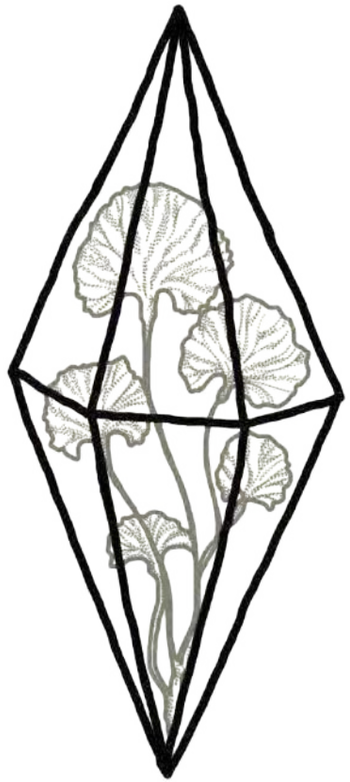
The precedent studies that were conducted as part of the typological investigation assisted in developing the required accommodation list, and started identifying how the different needs of the building would work together and be integrated. Many of the precedents that were studied had a large visual focus on an idea of pattern and symbolism. On the one hand, the extensive use of patterned skins displayed the importance of a kind of visual communication for laboratory projects that deal with rather secretive and sensitive information, and exemplified how work conducted on the inside can be revealed to the outside world. Nonetheless, the use of this kind of visual statement must be carefully and applicably incorporated. Ultimately, if correctly interpreted, a visual connection can assist in deterring the austere atmosphere traditionally associated with laboratories, in a way that merges certain poetic and functional requirements. The precedent studied for the Institute of Molecular Medicine, designed by Fagan Architects, conveyed the need of a building within a context of architecture from different periods to stand out from its surroundings in a way that is both forthright and sensitive. Linking to the precedent studies, the notion of humanising the scientific institute was further investigated through the personal case study. A first-hand experience grounded the importance of incorporating this aspect as a predominant design approach, which was further explored through additional research and literature review.

The process of analysing the proposed site and broader context grounded certain formative decisions. From this analysis, the decision was made to give both the corner and increasingly disused golf course back to the community. The site analysis revealed a means for the project to be formed from the site; to *grow from the container* and find certain ordering principles in the existing built environment.

A further precedent was studied to investigate the possibilities of applying unique approaches to the scheme of a scientific institute, and how the inclusion of a garden for fresh produce can be tectonically expressed. These aspects must be explored as a way of prompting community interest and including a component of nature to the laboratory as a means of integrating the idea of humanising the scientific institute.

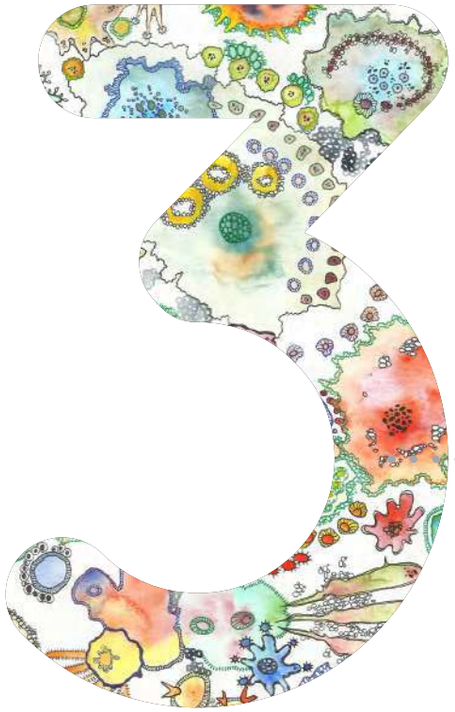
The review and interpretation of literature sources revealed how the world of scientific investigation and discovery, throughout history, has become veiled in mystery and secrecy. A principal approach to the design that was learnt from the review is the necessity of achieving a balance between the specialist knowledge of scientists and the inquisitive nature of the general public, and how the architectural expression must become the equalising component between the two aspects. As much as the design seeks to generate public interest, the work conducted by scientists must be protected. The institute must become a place of familiarity for both parties, instigating both curiosity and innovation. By investigating scientific facilities designed by I. M. Pei and Louis Kahn, the idea of creating a place of "sacred science" was discovered and explored; in other words, the two examples exemplify a means of bringing the forces of science and humanity into one spectrum of architectural design.

Finally, the start of the tectonic and structural investigation alluded to the structural systems and methods of construction that would be best suited to the needs of a laboratory facility. Additionally, these decisions had to be considered in terms of the conceptual approach, so that the smaller, more detailed tectonic expression could become indicative of the broader intentions of the scheme. It is intended that all these lessons are developed further through the process of personal design development, which will be communicated in the next part of the dissertation, which focuses on illustrating the design synthesis.



"All there is to thinking is seeing something noticeable which makes you see something you weren't noticing which makes you see something that isn't even visible."

- Normal Maclean, *A River Runs Through It and Other Stories* (1976)



3.1 THE FORMATIVE DESIGN
THE EXISTING HOUSES AS AN ORDERING PRINCIPLE

3.2 DIVERGING FROM THE PROCESS
MOVING AWAY FROM THE FORMATIVE IDEAS

3.3 REINTERPRETING THE ORIGINAL IDEAS
THE CONTAINER AND THE NOTION OF GROWTH

3.4 DESIGN DEVELOPMENT ON A MICRO-SCALE
CONFIGURATION OF THE COMPOSITION AND PROPORTIONS

3.5 CULMINATION OF THE DESIGN DEVELOPMENT
BALANCING CONCEPTUAL NOTIONS AND RATIONAL DESIGN EXPECTATIONS

3.6 INCORPORATION OF TECHNICAL IMPLICATIONS

3.7 DEVELOPMENT OF THE TECHNICAL DESIGN

3.8 **REVEALING THE INVISIBLE: TOWARDS THE FINAL DESIGN PROPOSAL**

3.9 **TECHNICAL RESOLUTION: DOCUMENTATION**

PART 3

DESIGN AND TECHNICAL SYNTHESIS

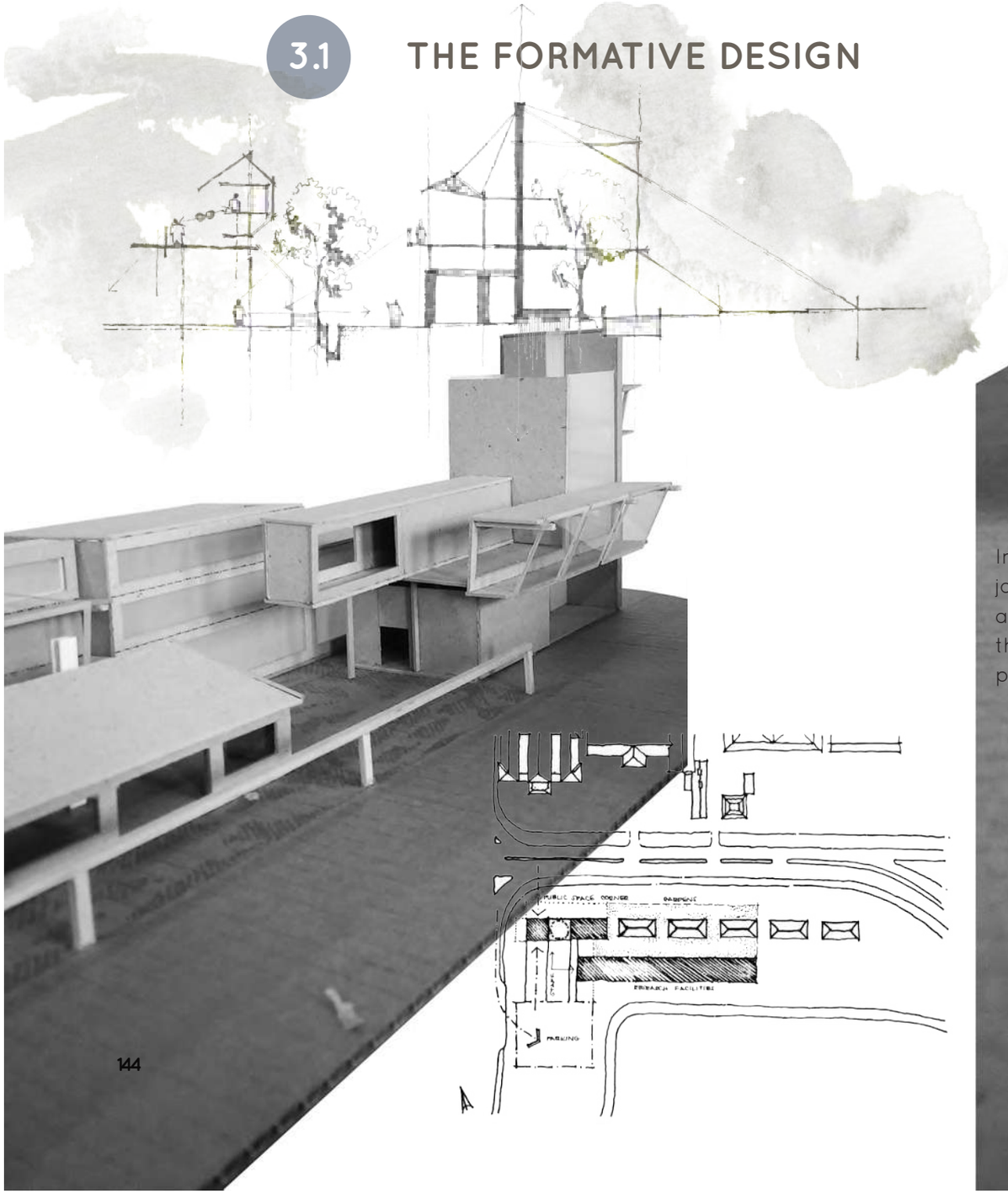
Although the framework of this dissertation is presented as a linear process, the development of the design proposal was continuous. In other words, the progression of the design synthesis developed in conjunction with the research and analysis discussed in Part 2 as an ongoing and changing process. The analyses of the site and precedents discussed in Part 2 assisted in developing certain parameters and guidelines for the proposal, while the research conducted under morphology allowed for a more unconventional outlook with regard to this building typology. Additionally, because of the building typology, structural and technical considerations were made alongside design decisions, as the two are fundamentally codependent.

In terms of the design process itself, the act of building physical models was integral to the development of the proposal. Because of the extents of the site, and the challenges involved with finding the correct placement with regard to the corner, physical models allowed for an understanding of the proposal's proportions and compositional changes. Furthermore, these models allowed for different components within the development stages to be combined; taking what worked in one proposal and combining it with what was successful in another. These models originated from the first three models built for the initial conceptual development, and then moved towards more realisable building developments.

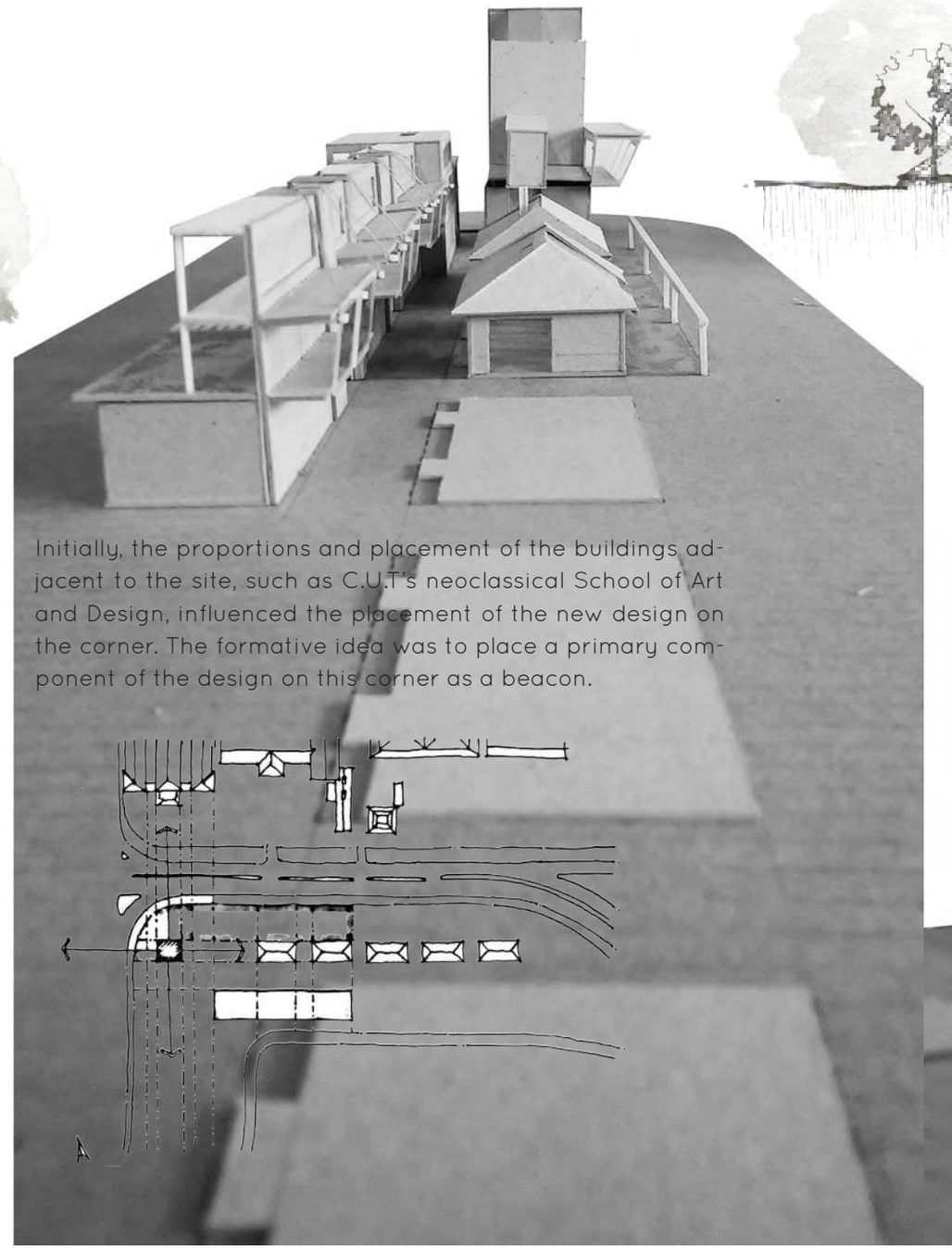
The process was hindered at certain stages by indecision regarding how to handle some of the existing structures on the site. Nonetheless, these structures ultimately contributed to many of the morphological decisions made for the design proposal, and are therefore intended to contribute to the "unique approach" of designing a scientific institute.

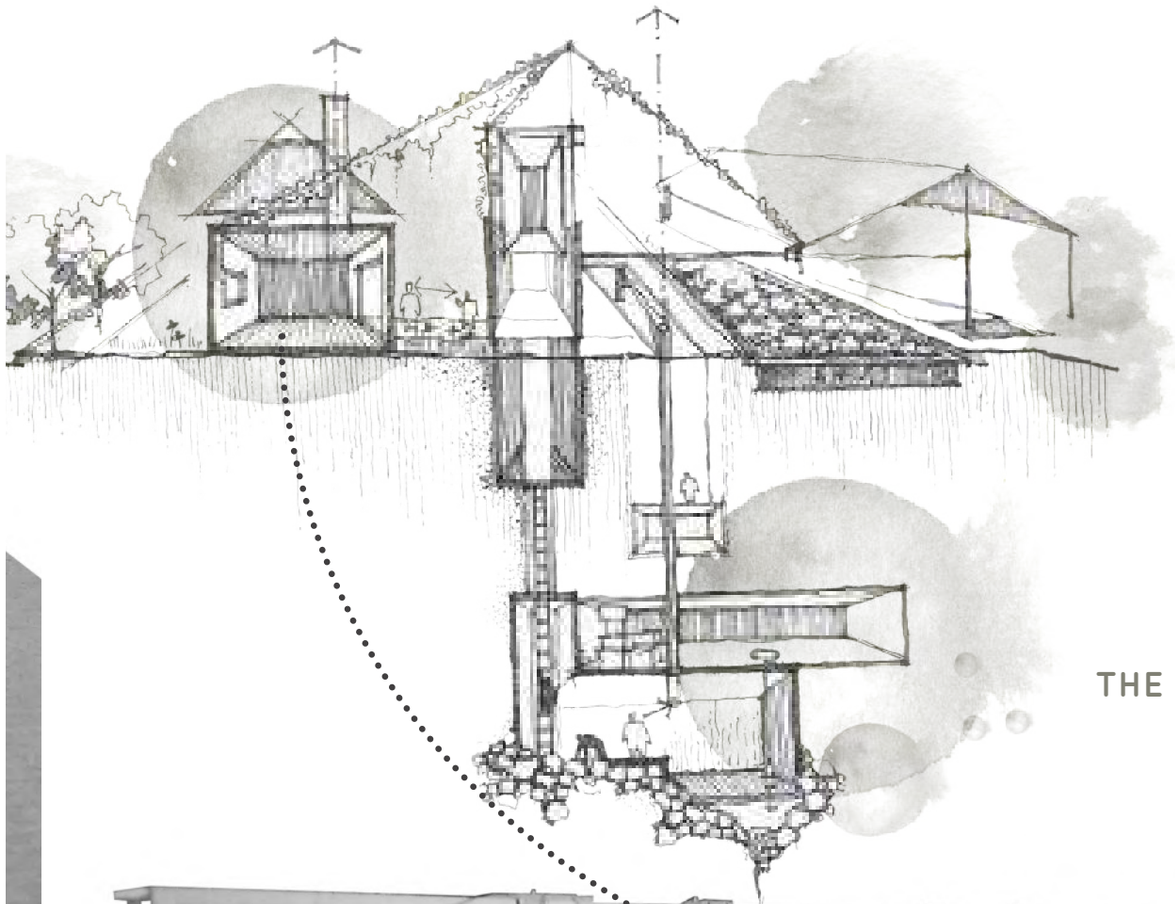
As a whole, Part 3 is a culmination of both design and technical decisions. At a certain stage in the design process, the development was put into an architectural computer program to assist in structural decisions and implications. Therefore, a new challenge arose in that often some of the intuitive creativity that precedes technical decisions can be lost while attempting to document the design proposal as a realisable building project.

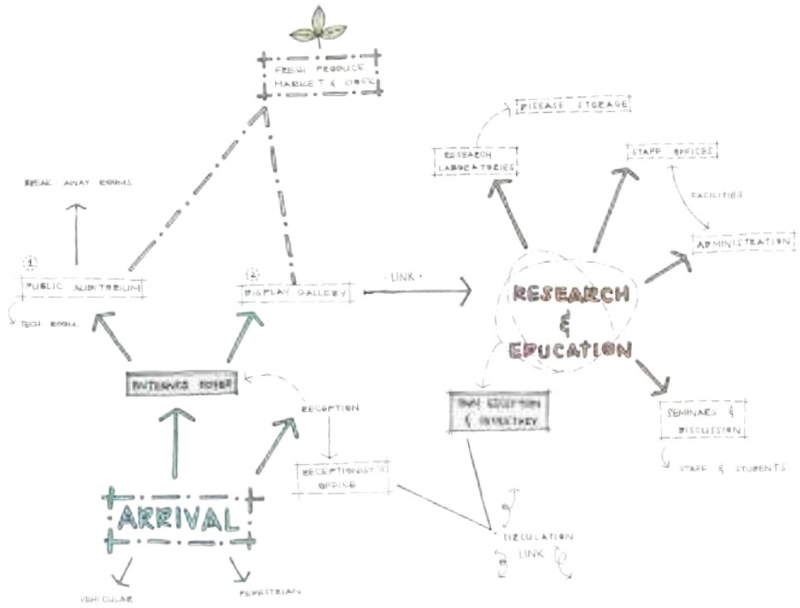
3.1 THE FORMATIVE DESIGN



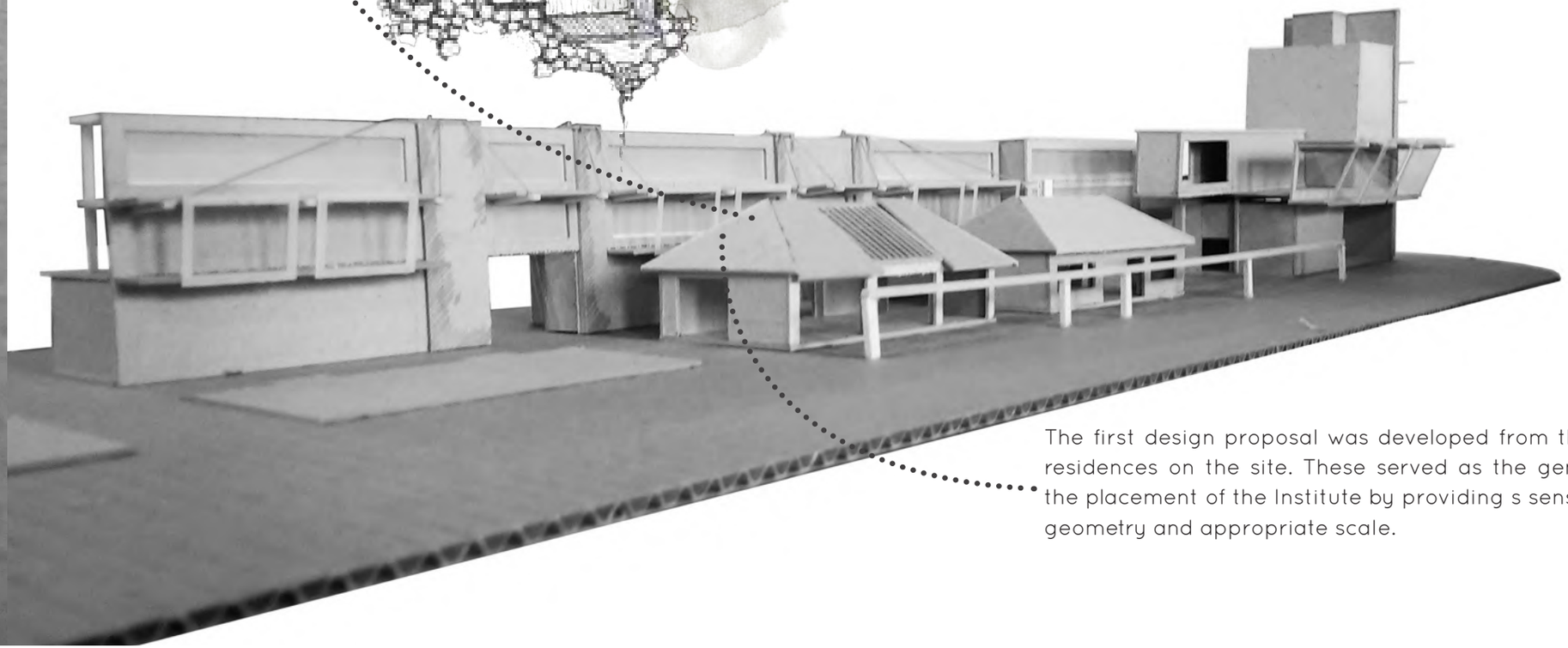
Initially, the proportions and placement of the buildings adjacent to the site, such as C.U.T's neoclassical School of Art and Design, influenced the placement of the new design on the corner. The formative idea was to place a primary component of the design on this corner as a beacon.





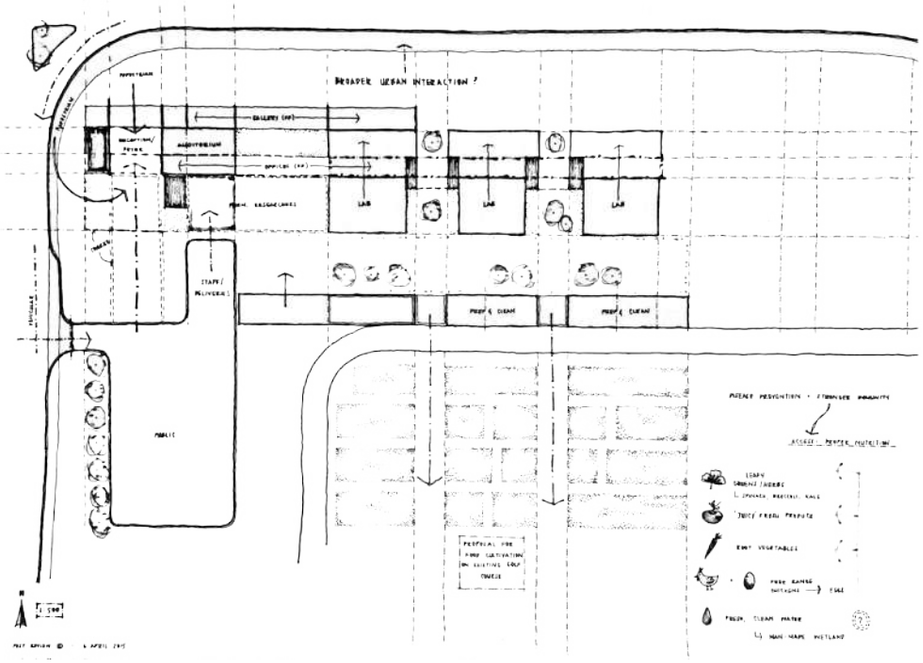


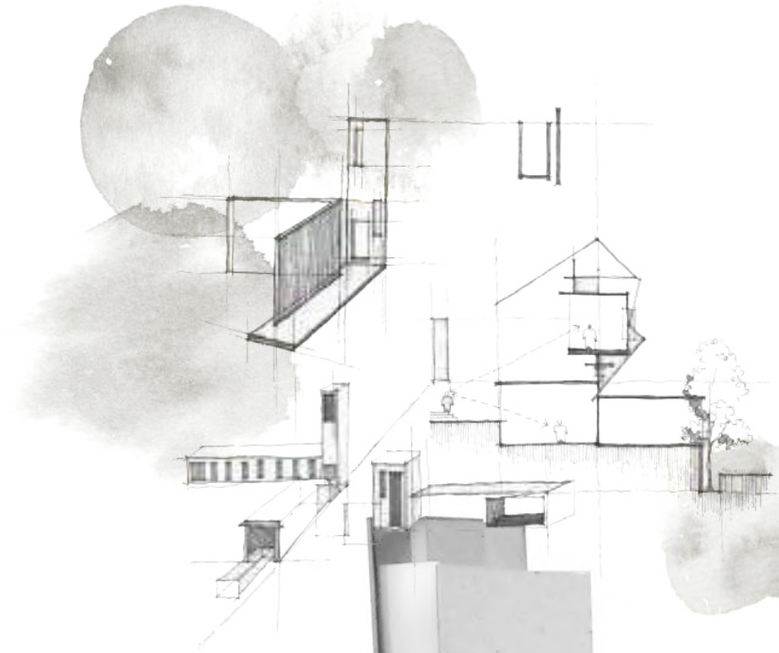
THE EXISTING HOUSES AS AN ORDERING PRINCIPLE

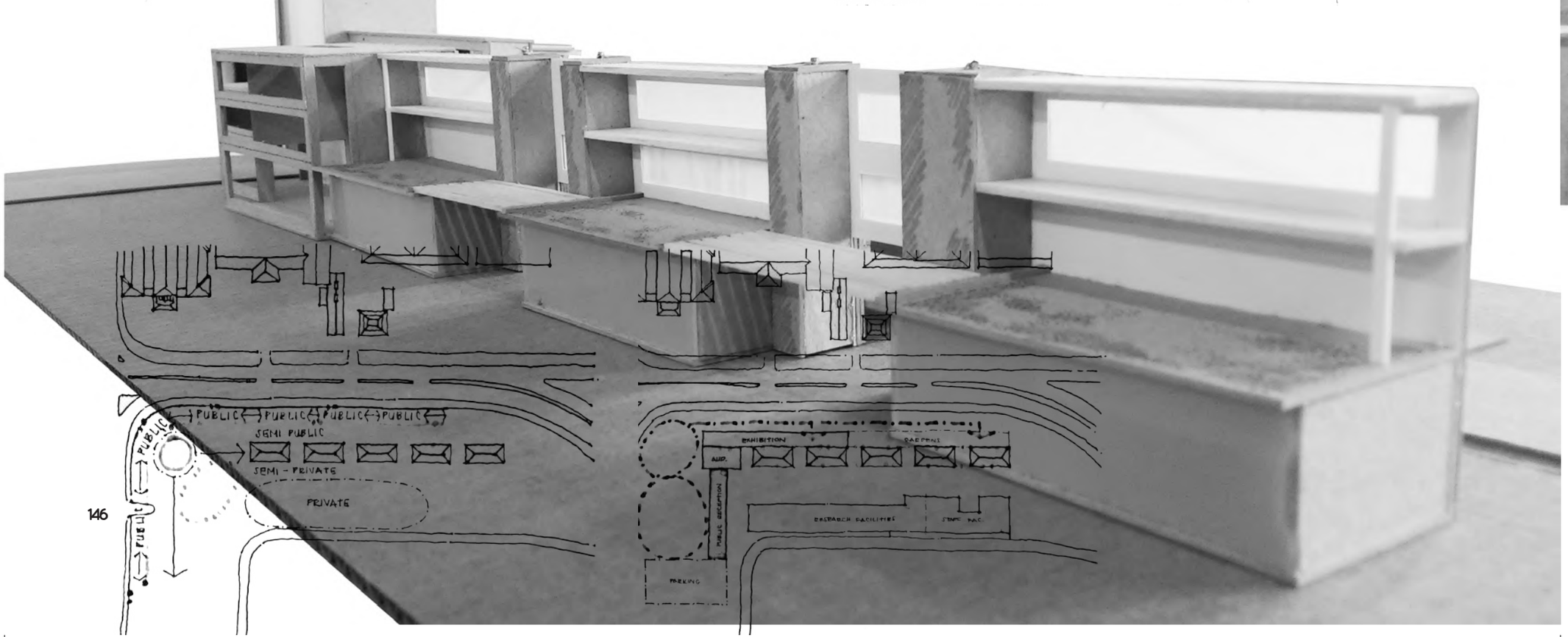


The first design proposal was developed from the existing residences on the site. These served as the generator for the placement of the Institute by providing s sense of order, geometry and appropriate scale.

From the beginning of the process, it was decided that the vegetable gardens would be planted for the community towards the back of the Institute. In this way, nutritional components could be explored by scientists employed by the institute, and the gardens could form part of a proposal for a broader future development.



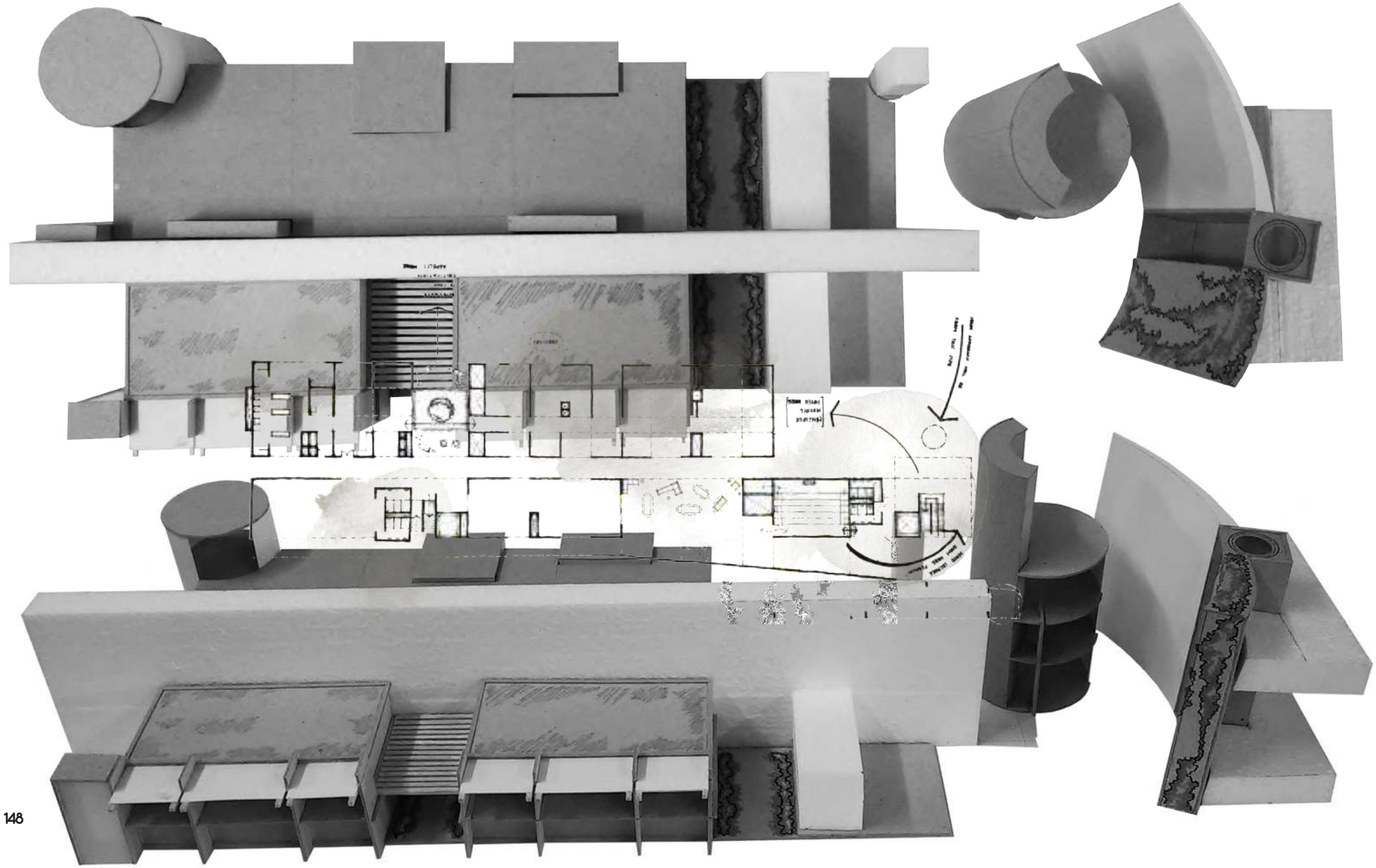




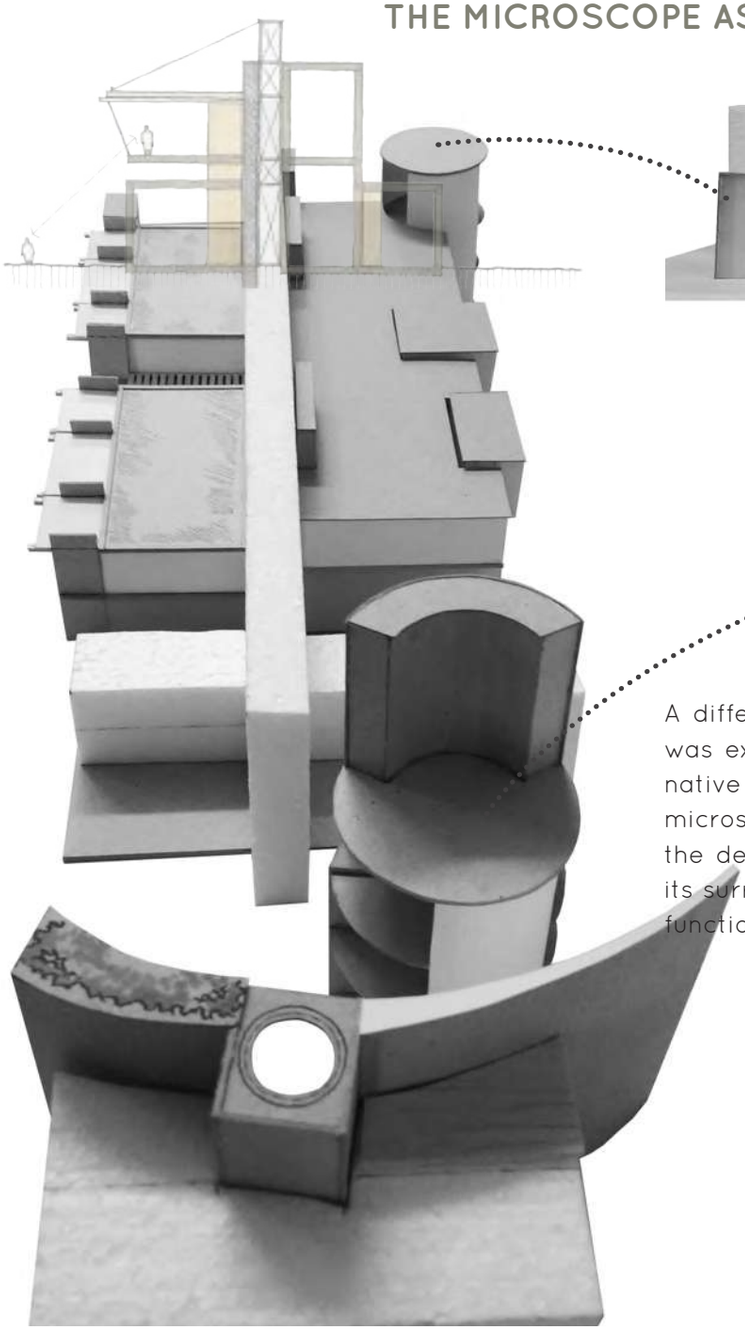
GENERATING A CONNECTION
TO NATURAL ELEMENTS

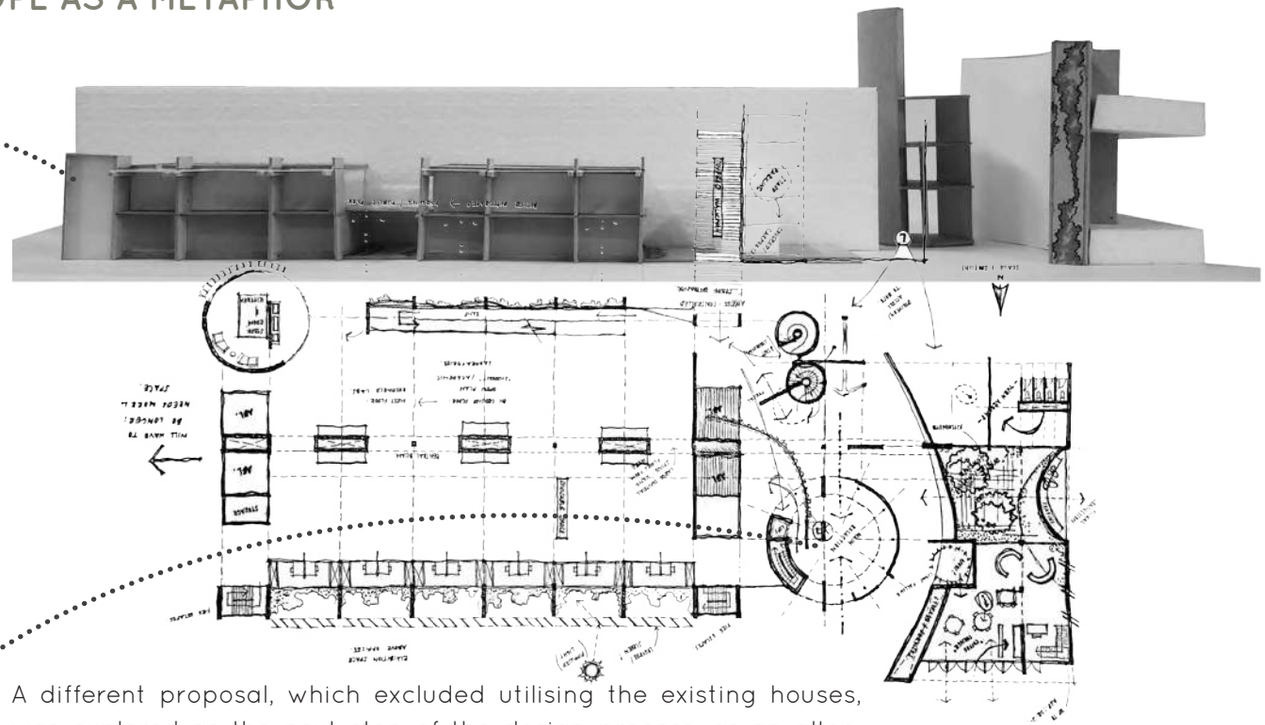
Utilising the existing residences could allow for a "human aspect" and a primitive notion of home to be included in the design of a scientific research building, which conventionally alienates human beings.

3.2 DIVERGING FROM THE PROCESS

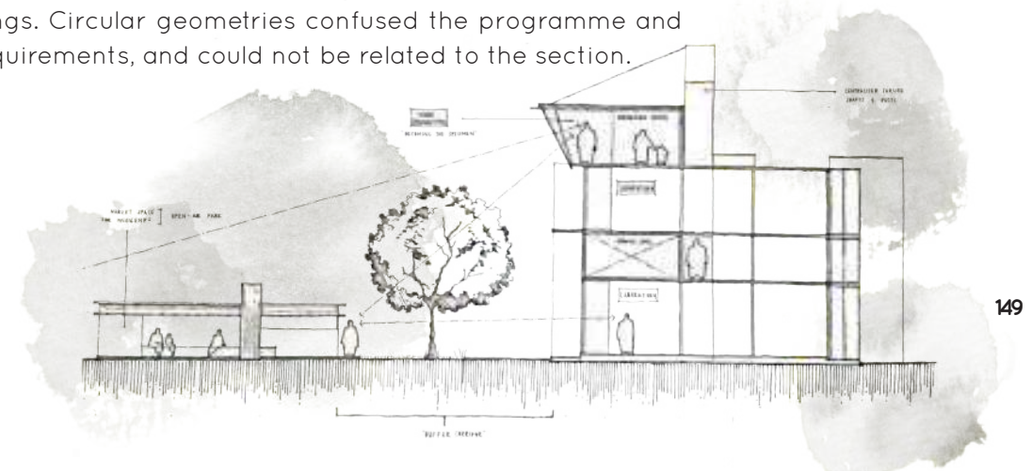


MOVING AWAY FROM THE FORMATIVE IDEAS: THE MICROSCOPE AS A METAPHOR



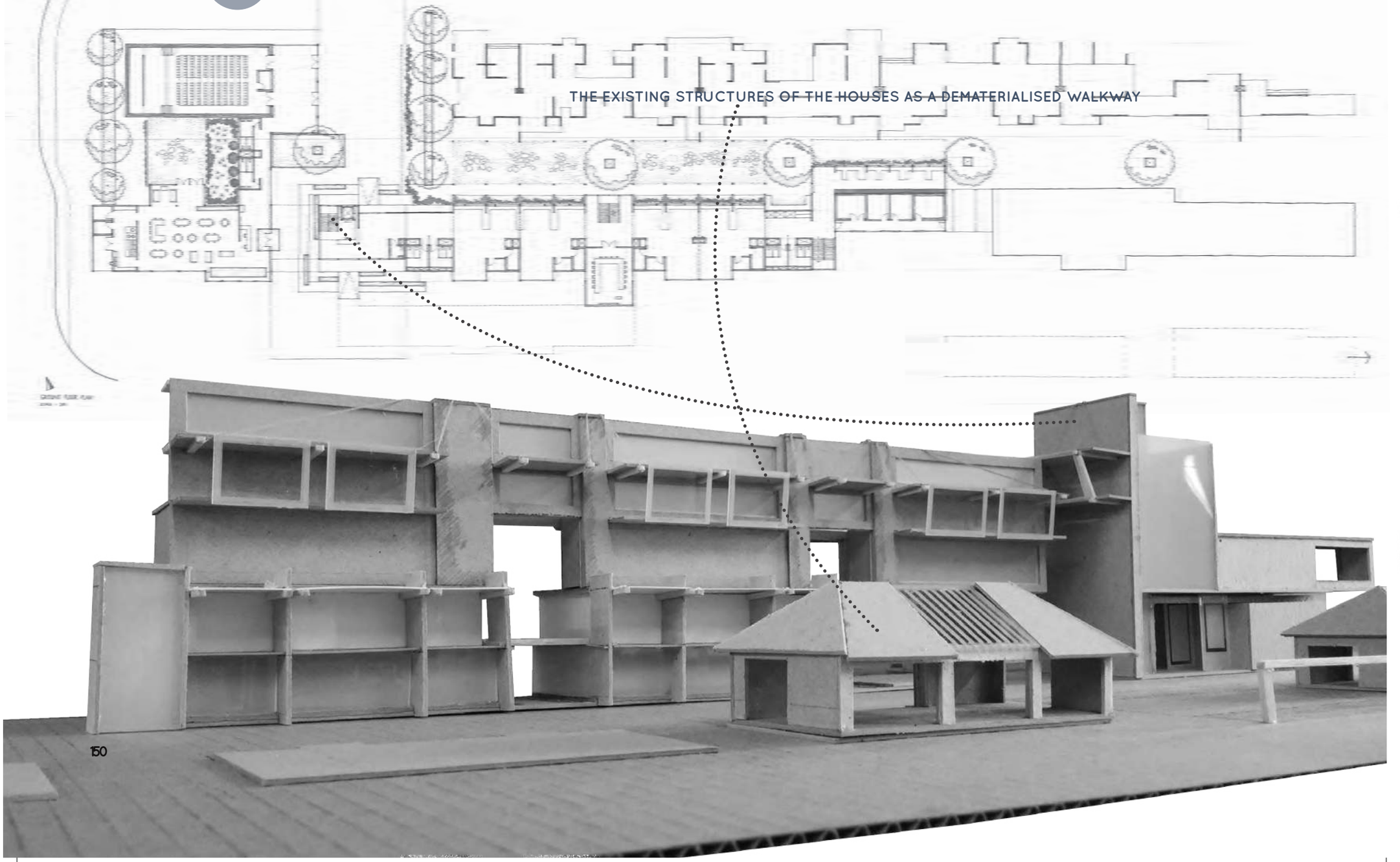


A different proposal, which excluded utilising the existing houses, was explored as the next step of the design process, as an alternative to the first development. At this stage, the idea of using the microscope as a conceptual metaphor was incorporated. However, the design became too much of an "object" and did not relate to its surroundings. Circular geometries confused the programme and functional requirements, and could not be related to the section.

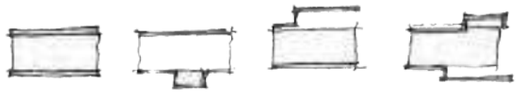


3.3 REINTERPRETING THE ORIGINAL IDEAS

THE EXISTING STRUCTURES OF THE HOUSES AS A DEMATERIALISED WALKWAY



THE CONTAINER AND THE NOTION OF GROWTH

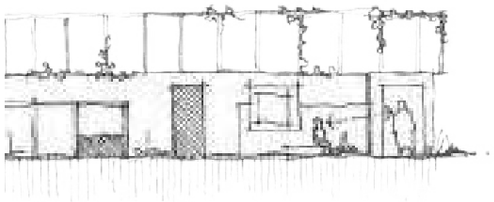


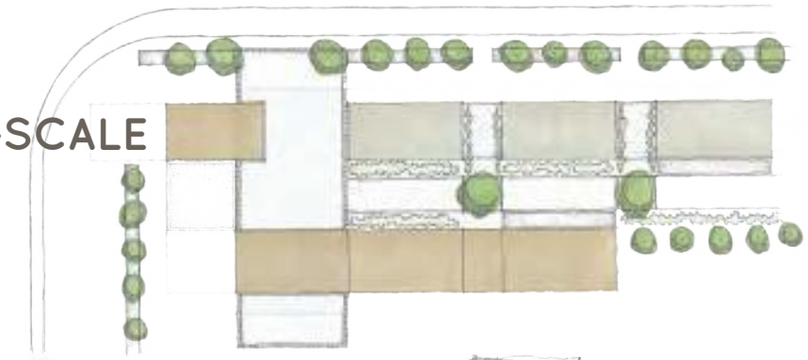
Eventually, it was concluded that the alternative to the formative ideas was unsuccessful, and the development of the design moved back to the first intuitive ideas. The existing houses would not be kept entirely, but would rather be utilised as a way of engendering a sense of memory and human familiarity. In other words, an ode to the notion of "home" would be made, whereby the existing residences could be dematerialised and broken up to reveal what was once hidden. The walls and structural elements could divide and spread apart, "exploding the box" in some way that could allude to the concept of the "container and growth". From these residences, perceived then as the *containers* found on site, the Institute could grow and develop. The intent was to keep some of the history of the context in that it was a predominantly residential area, which is going through a process of transformation.

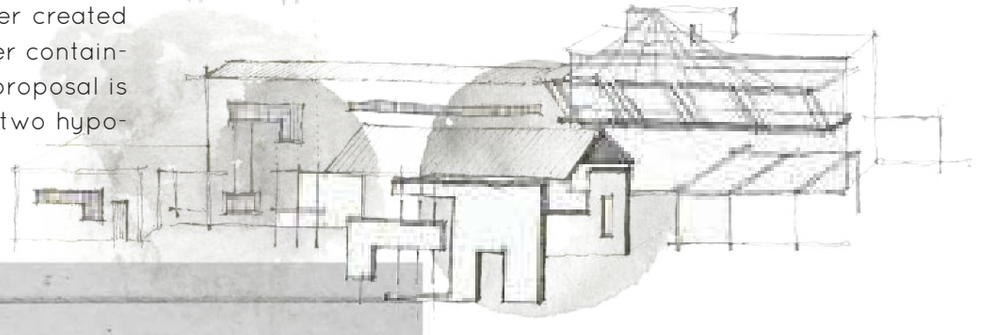
Therefore, the design proposal could be developed as a manifestation of these transitory phases: the front residences as a "growing", tectonic expression contrasted by the monolithic research laboratory behind it, with an intermediate semi-monolithic inter-phase connection that links these two components.

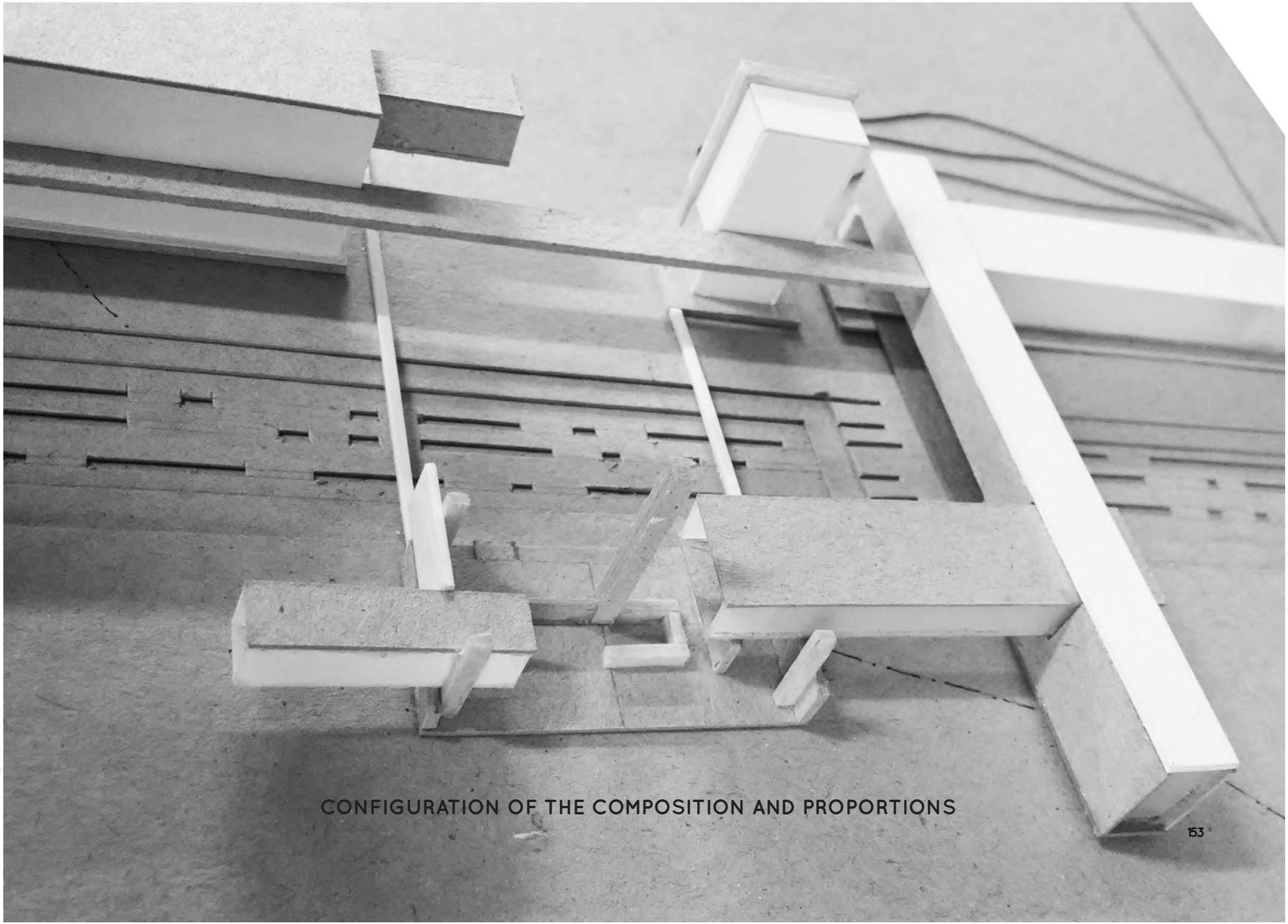
3.4 DESIGN DEVELOPMENT ON A MICRO-SCALE

Once the decision was made to utilise the existing houses for the purpose of conceptual notions, the design proposal was developed on a scale of 1:500 within the context to determine an appropriate scale and aesthetic composition. A shallow ditch on the site which collected water created a micro-oasis and was then perceived as another container from which growth could occur. The design proposal is therefore intended to link and grow from these two hypothetical containers.







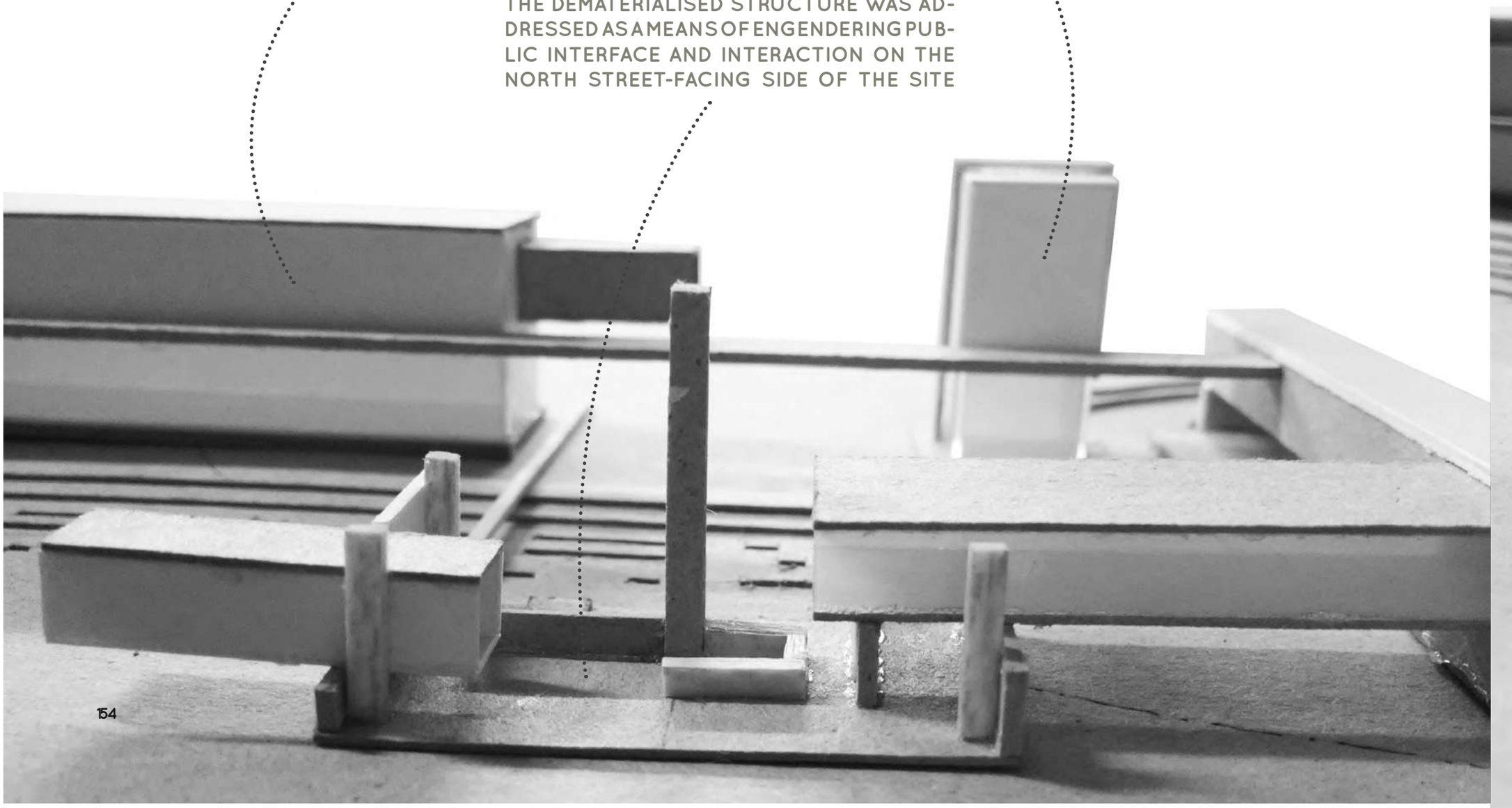


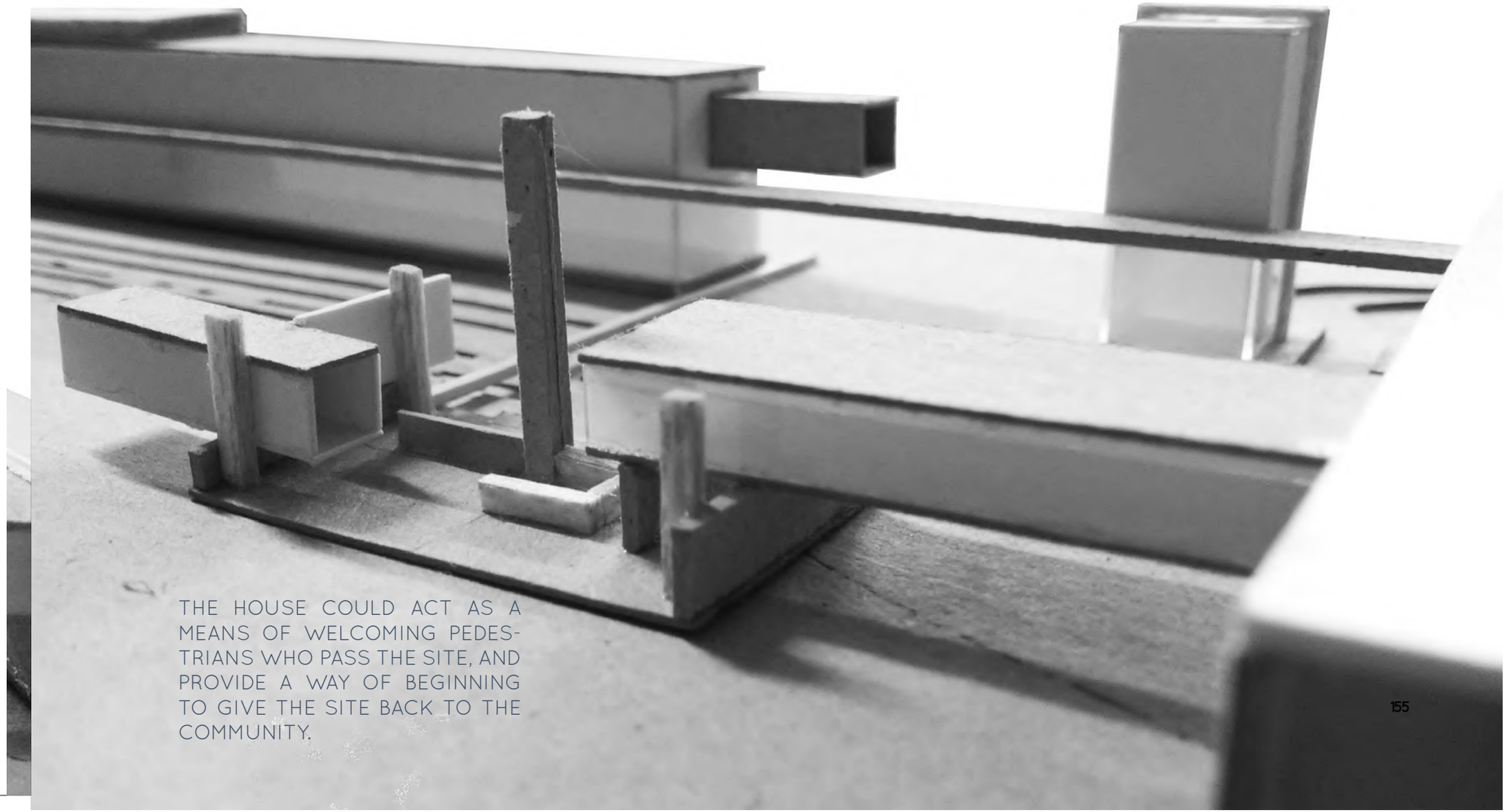
CONFIGURATION OF THE COMPOSITION AND PROPORTIONS

RESEARCH FACILITIES AND LABORATORIES

CIRCULATION TOWER

THE DEMATERIALISED STRUCTURE WAS ADDRESSED AS A MEANS OF ENGENDERING PUBLIC INTERFACE AND INTERACTION ON THE NORTH STREET-FACING SIDE OF THE SITE

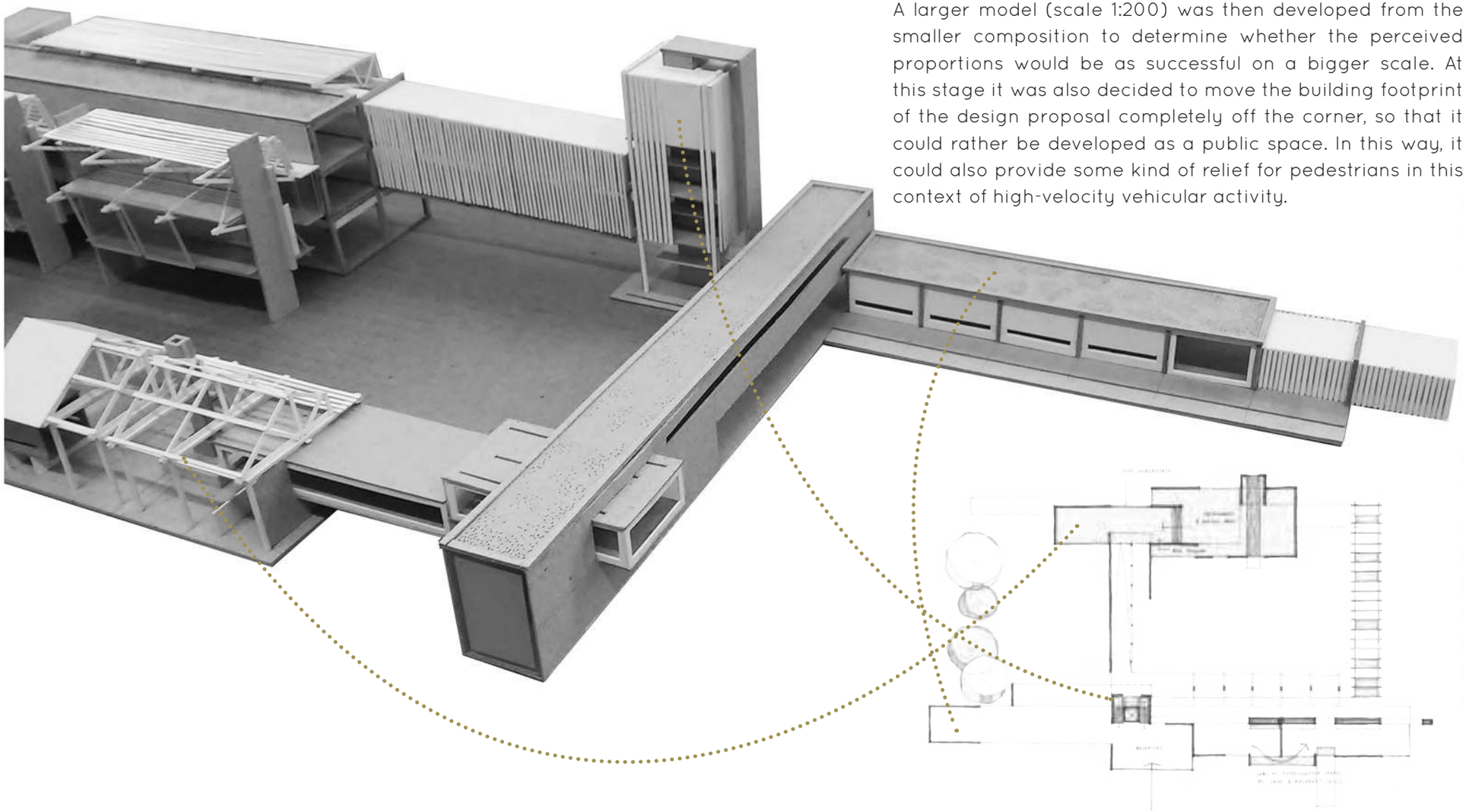




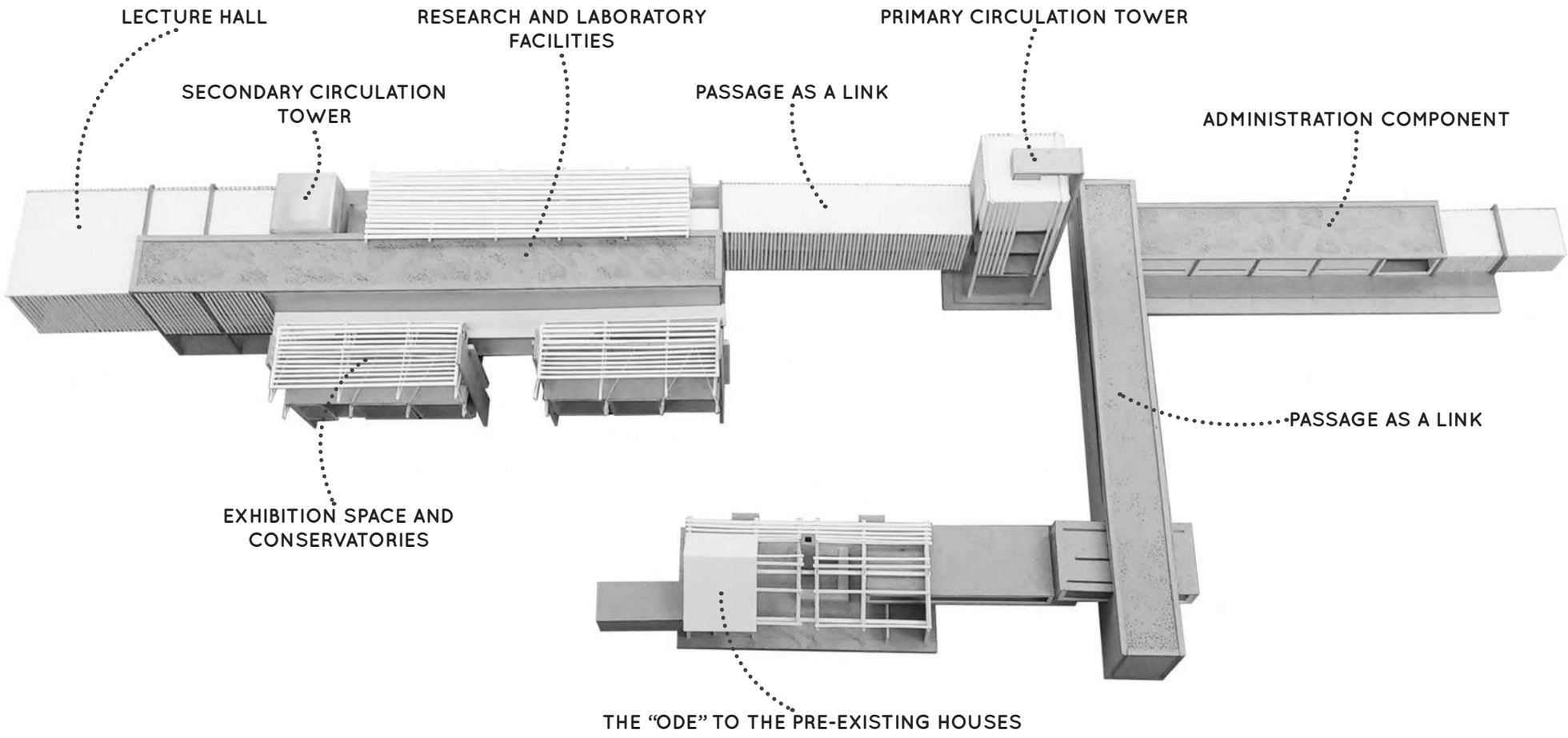
THE HOUSE COULD ACT AS A MEANS OF WELCOMING PEDESTRIANS WHO PASS THE SITE, AND PROVIDE A WAY OF BEGINNING TO GIVE THE SITE BACK TO THE COMMUNITY.

3.5 CULMINATION OF THE DESIGN DEVELOPMENT

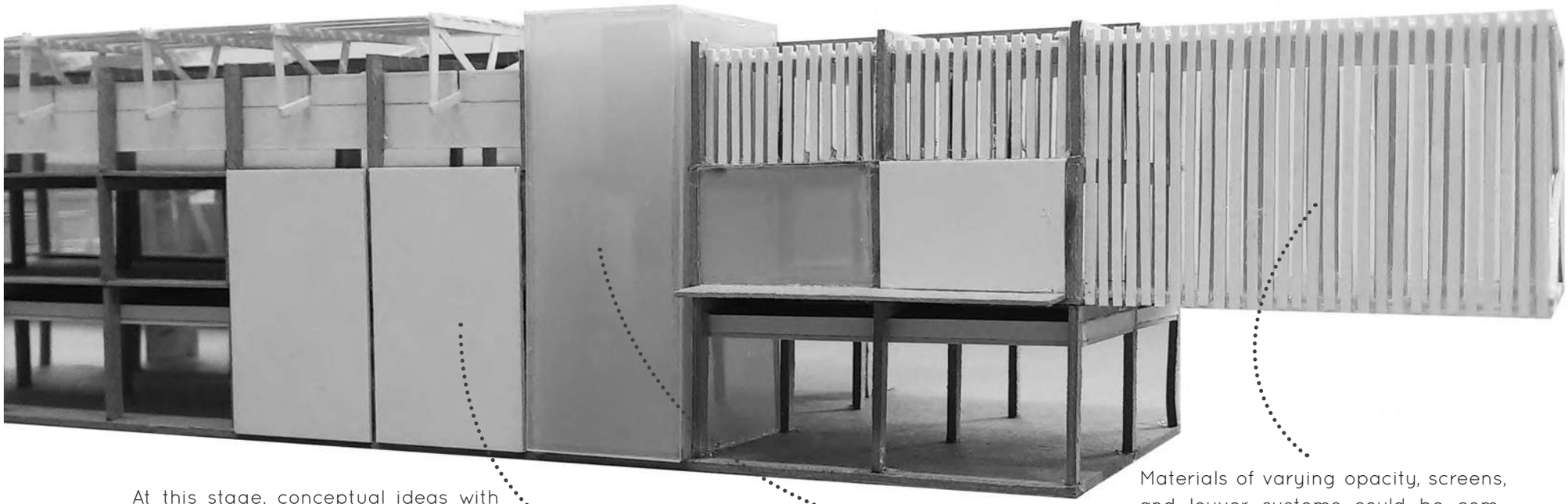
A larger model (scale 1:200) was then developed from the smaller composition to determine whether the perceived proportions would be as successful on a bigger scale. At this stage it was also decided to move the building footprint of the design proposal completely off the corner, so that it could rather be developed as a public space. In this way, it could also provide some kind of relief for pedestrians in this context of high-velocity vehicular activity.



SEEKING A PROPOSAL THAT BALANCES CONCEPTUAL NOTIONS WITH RATIONAL DESIGN EXPECTATIONS

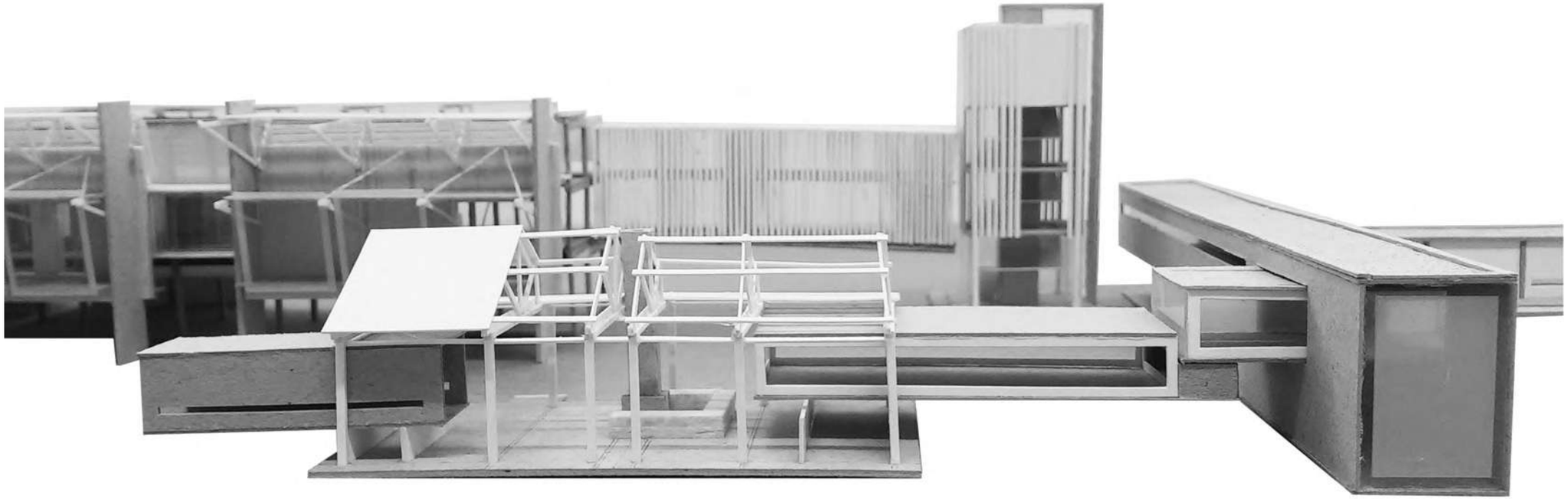


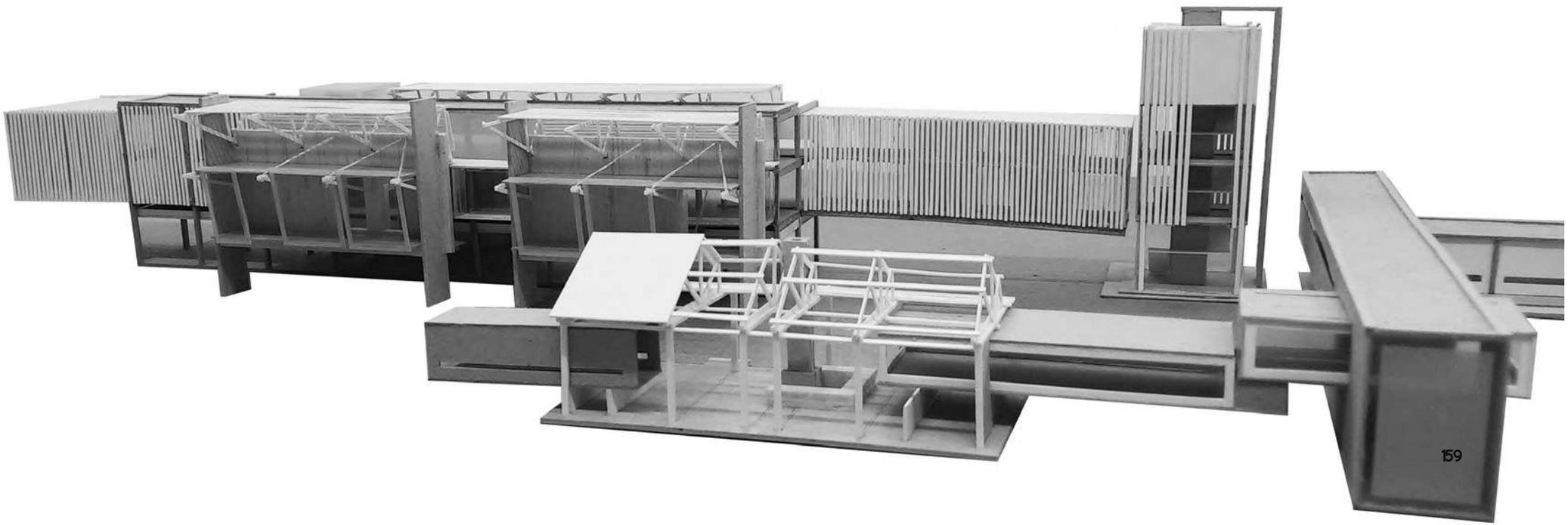
PRELIMINARY FUNCTIONAL ARRANGEMENT

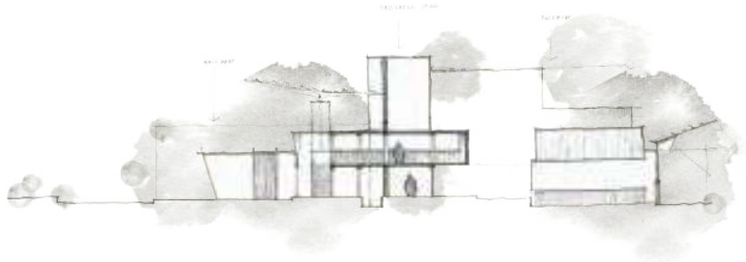


At this stage, conceptual ideas with regard to translucency, opacity and "revealing the invisible" could be further explored through architectural expression and material associations.

Materials of varying opacity, screens, and louver systems could be combined and layered to create a gradient in visual connectivity to what is happening inside the laboratories.

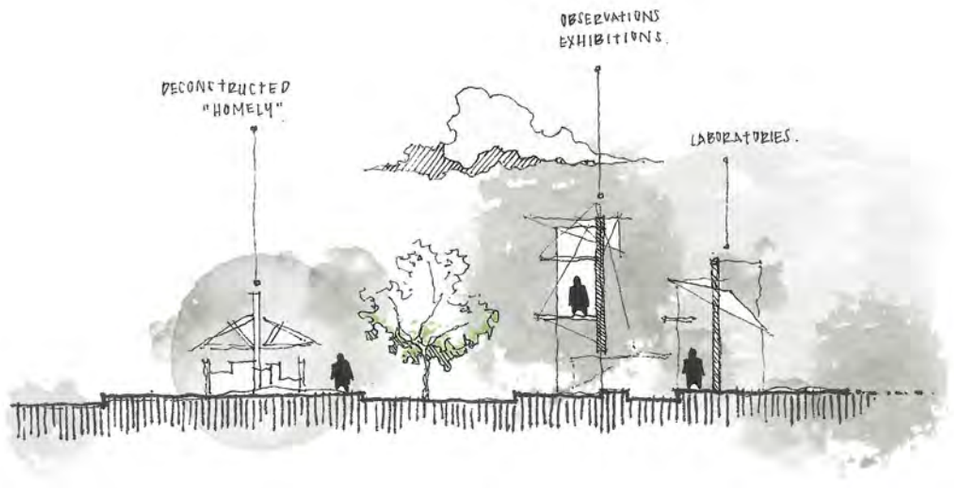


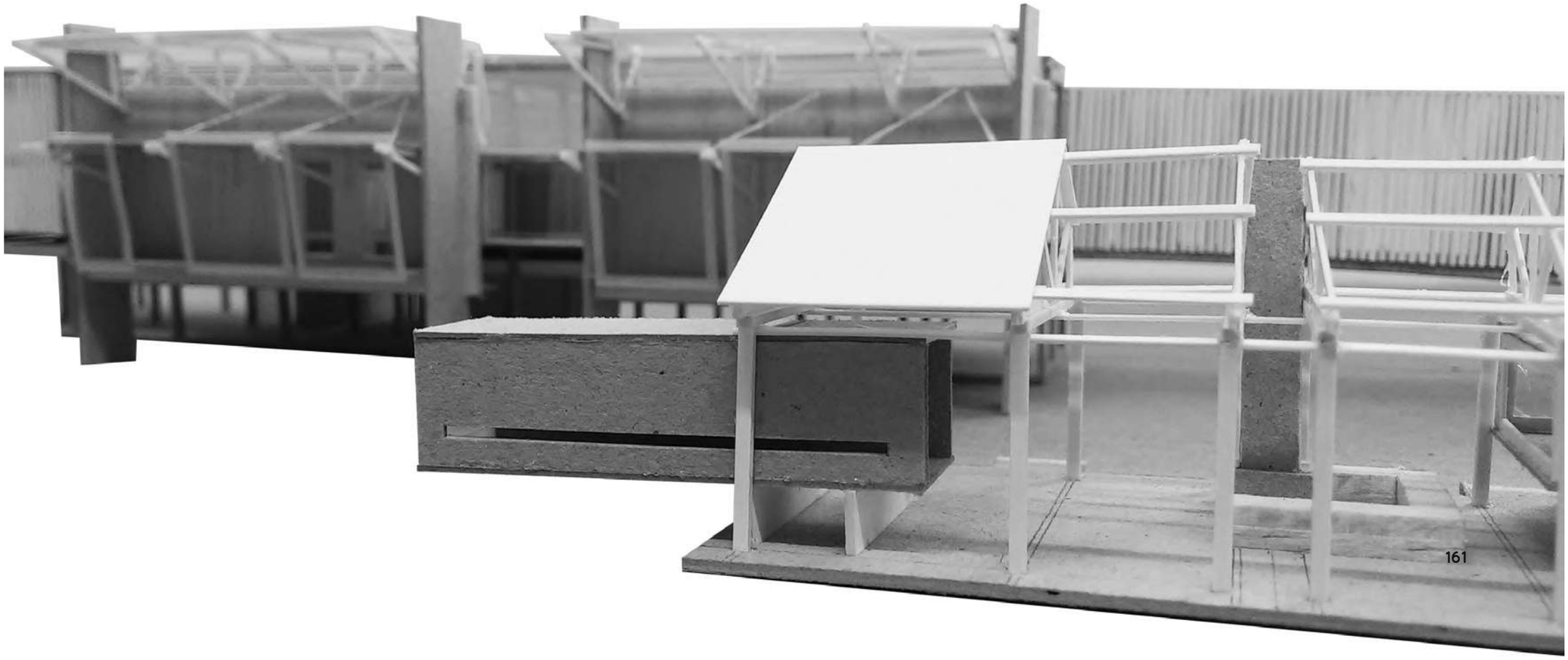


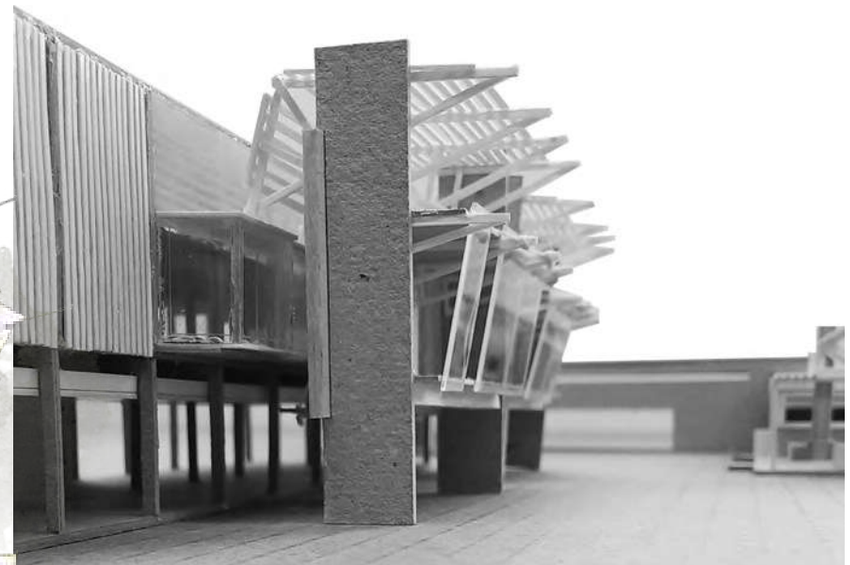


Link passages and components of the design are intended to convey an idea of boxes protruding from one another; growing and puncturing, to create an idea of a larger box broken into smaller parts.

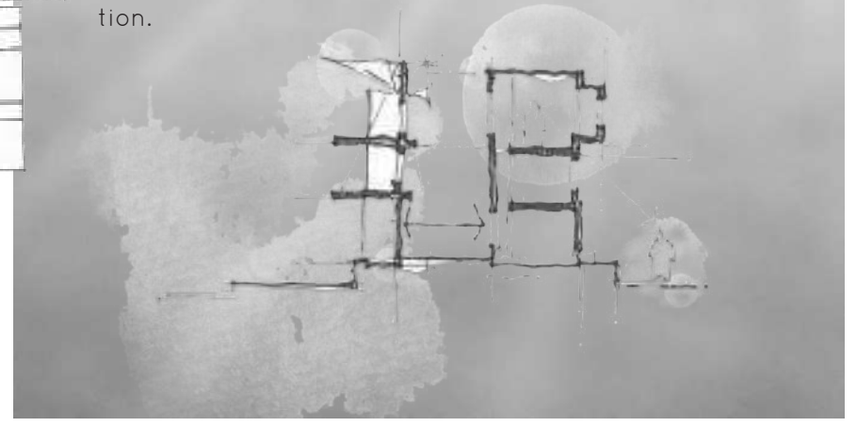
The memory of the houses that exist on the site convey an idea of "homeliness", comfort and familiarity. The laboratories allude more to an idea of the "unhomely" and unfamiliar. There is a tension between these two forces and an opportunity for a method of intermediate connection; a component or element of design that create balance.

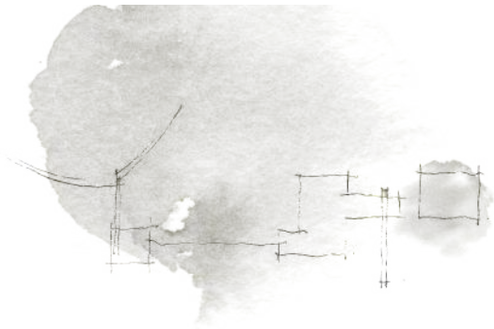




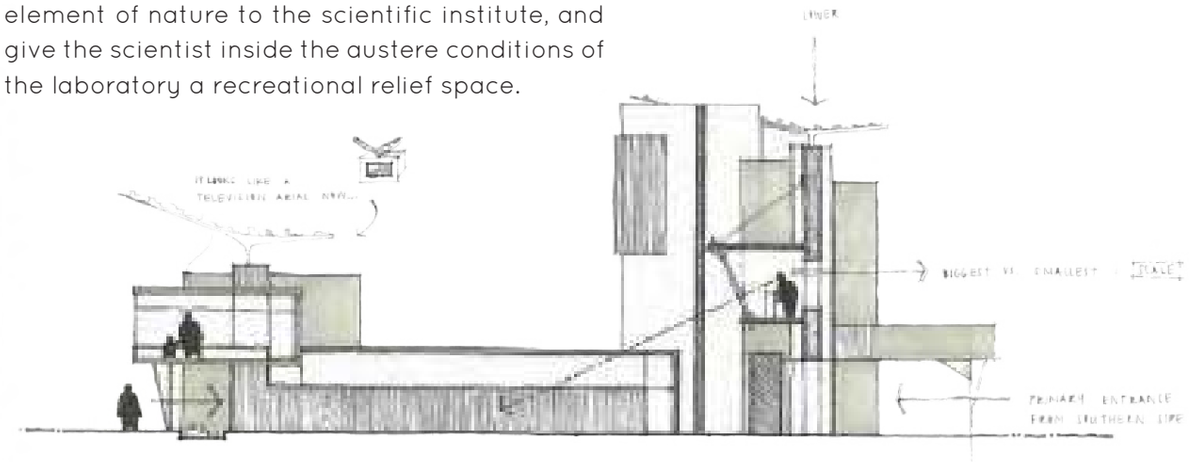


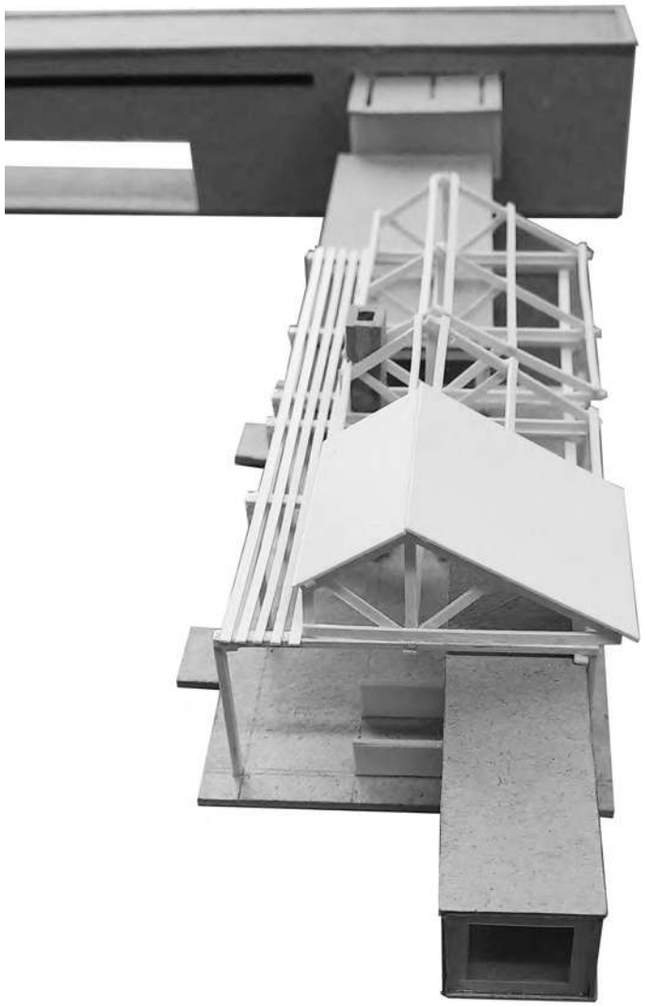
The conservatories and exhibition boxes that line the north facade of the laboratory facilities become this component of balance. As a structure that incorporates both monolithic and tectonic elements, these front boxes act as both a screen shielding the laboratories, and also provide a way for observers to see somewhat into the laboratory spaces from the outside through the translucent screens. In this way, the scientist inside also becomes a specimen of observation.

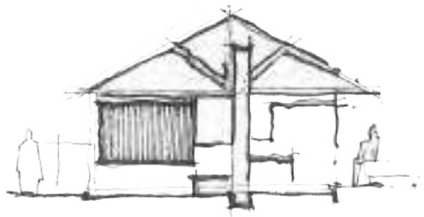




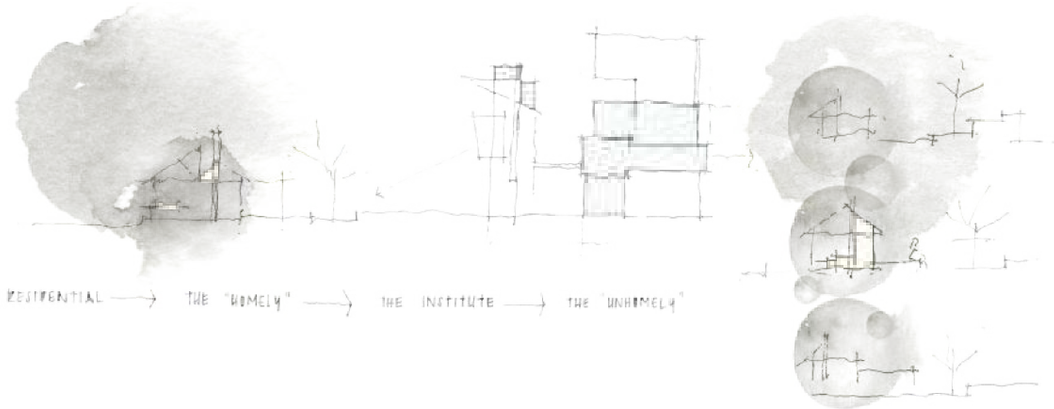
The conservatory boxes are intended to bring an element of nature to the scientific institute, and give the scientist inside the austere conditions of the laboratory a recreational relief space.

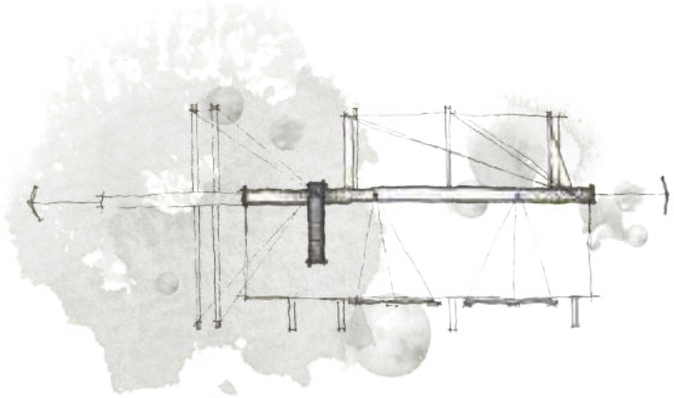




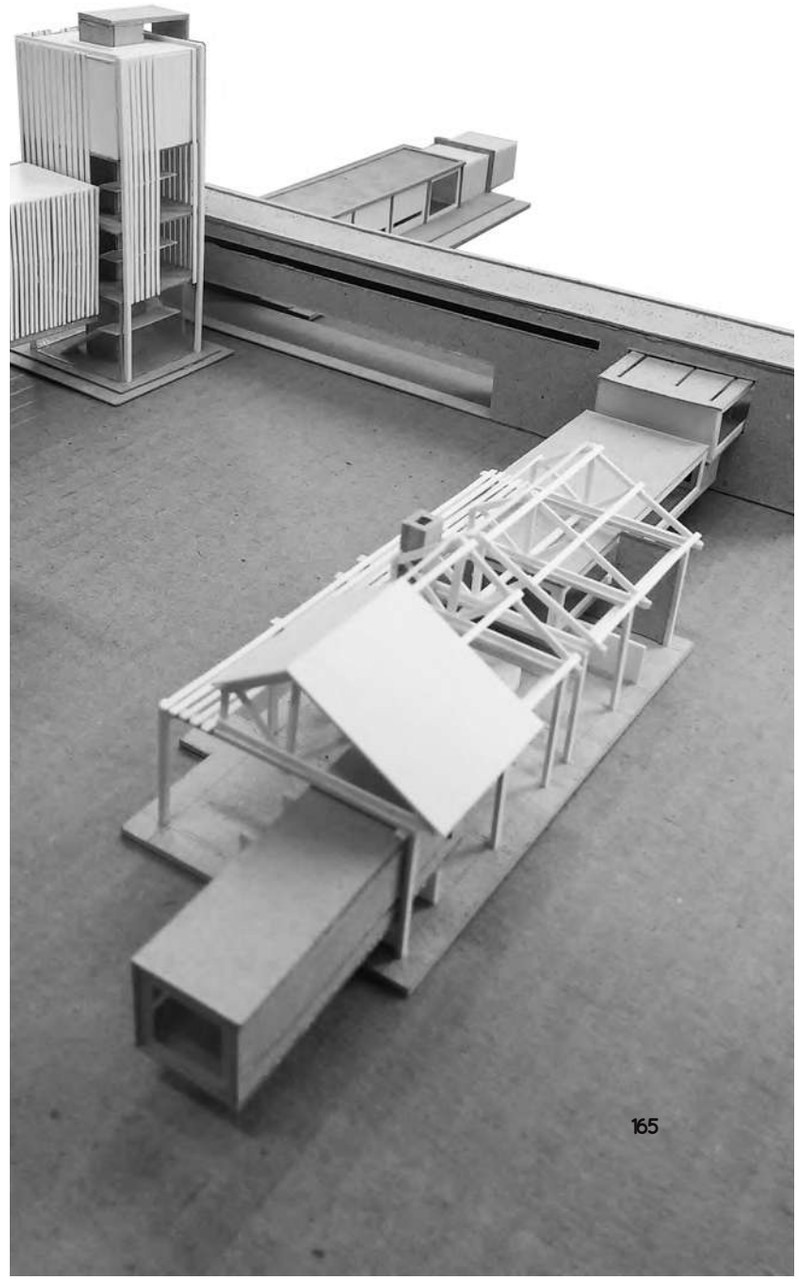


The inclusion of a dematerialised memory of the original houses in the design proposal is intended to bring forth an idea of the "architectural ruin". The materiality and expression of the house, so to speak, alludes to notions of decay and the natural forces of time. Decay and time remind human beings of their mortality, and contrast the attempts of many contemporary buildings to "defeat the terror of time". Where the laboratory is a clean, austere environment, the development of the exterior spaces and walkways leading from these odes to the houses alludes to a more romanticised notion of time and existence. Therefore, the sterile laboratory environment is balanced by the inclusion of these natural elements and textured materials that evoke hapticity.

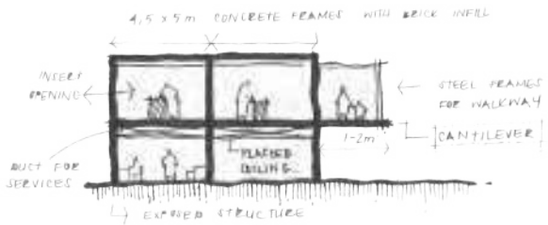




The “box” of the house is exploded so that components may “grow” from it. These alignments are intended to frame certain views for the observer, while simultaneously framing the observer as a specimen for observation. Therefore, there is a tension between these two notions as being both the observer and the observed.
Furthermore, these views allude to conceptual ideas of defining perspective, and how human beings have to change both their visual and intellectual perspectives when it comes to learning about and understanding the world of microscopic organisms.



In order to find a tectonic expression of the conceptual ideas, the structure of the laboratory facility is contrasted with that of the ode to the houses and conservancy boxes. The concrete frame used for the laboratory component of the design proposal is intended to express itself as a monolithic element; a place of safe-keeping that holds the specialised knowledge and practices conducted by the scientists who work inside. This frame is then covered and exposed at varying places as an intention to reveal some of this knowledge to the public through observation. By utilsing materials that allow for translucency and entire transparency, the outside observer is allowed a glimpse of what happens inside the laboratory, without revealing all or compromising the sensitive nature of work conducted.



CONNECTIVE AND OVERLAPPING COMPONENTS

ADMINISTRATION COMPONENT

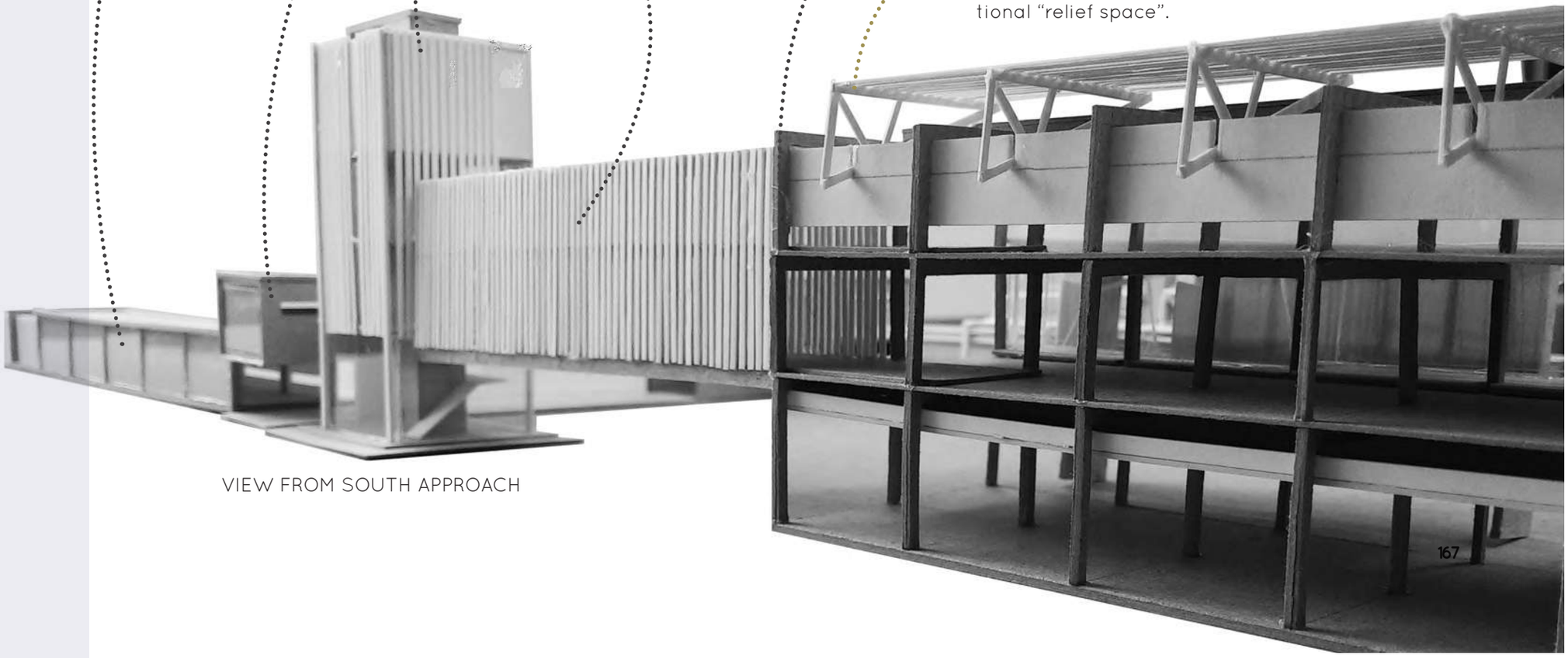
PRIMARY CIRCULATION TOWER

RESEARCH AND LABORATORY FACILITIES

An element of the tectonic expression used for the conservatory boxes is brought into the research and laboratory facility component, with the intention of creating a habitable roof terrace, and providing the scientists with an additional "relief space".

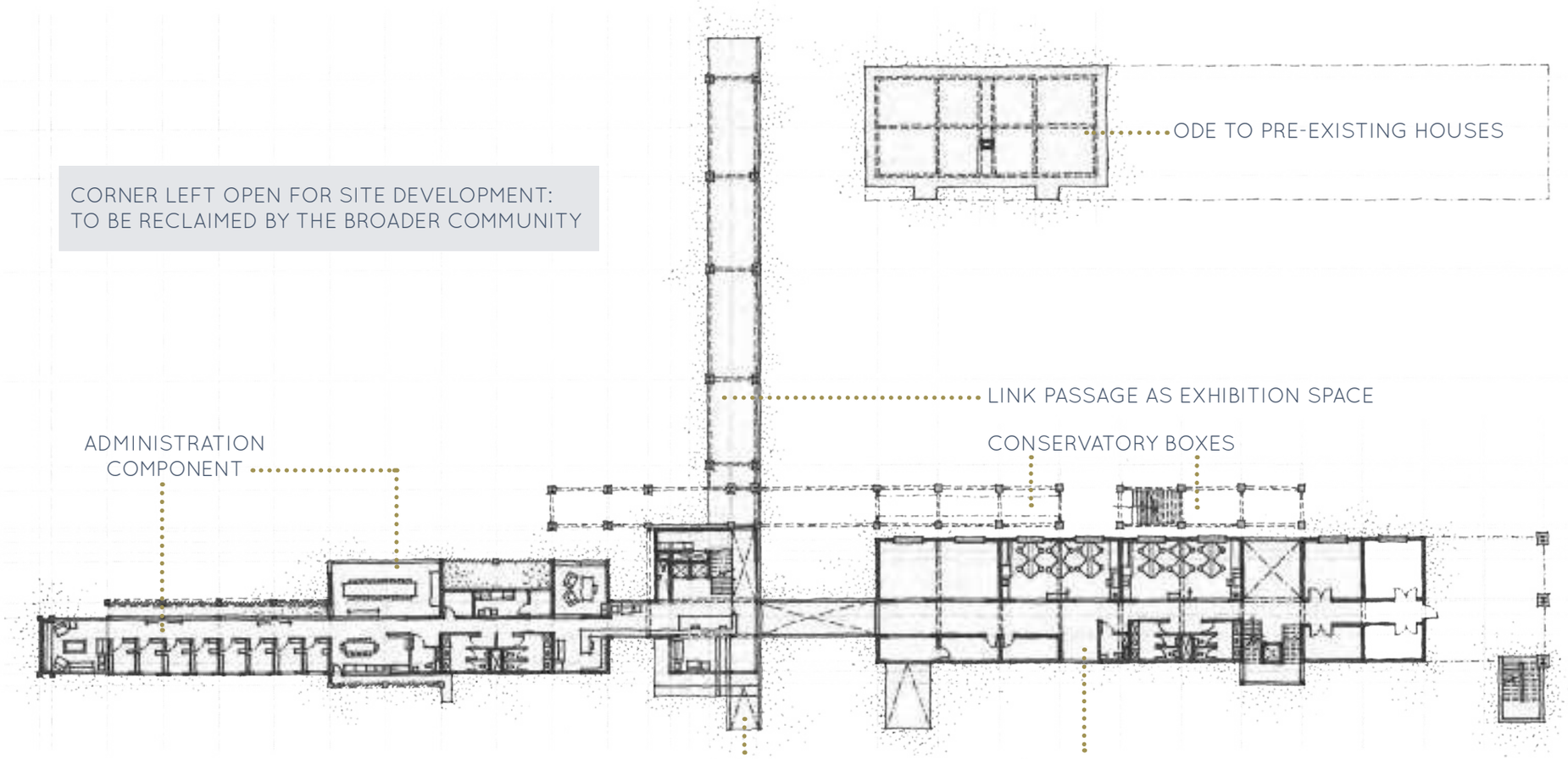
LINK PASSAGE

LINK PASSAGE

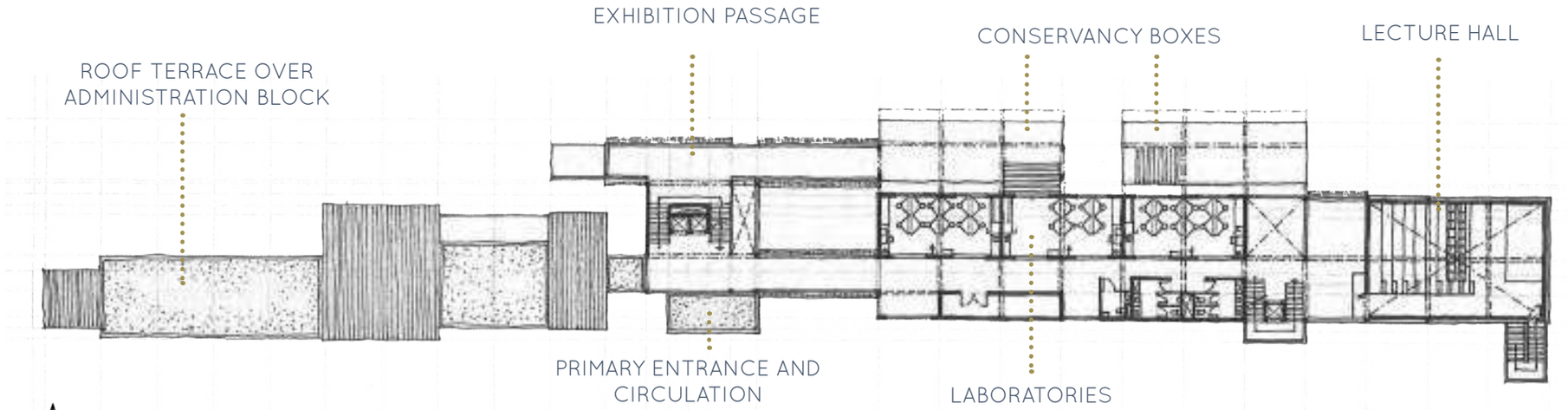


VIEW FROM SOUTH APPROACH

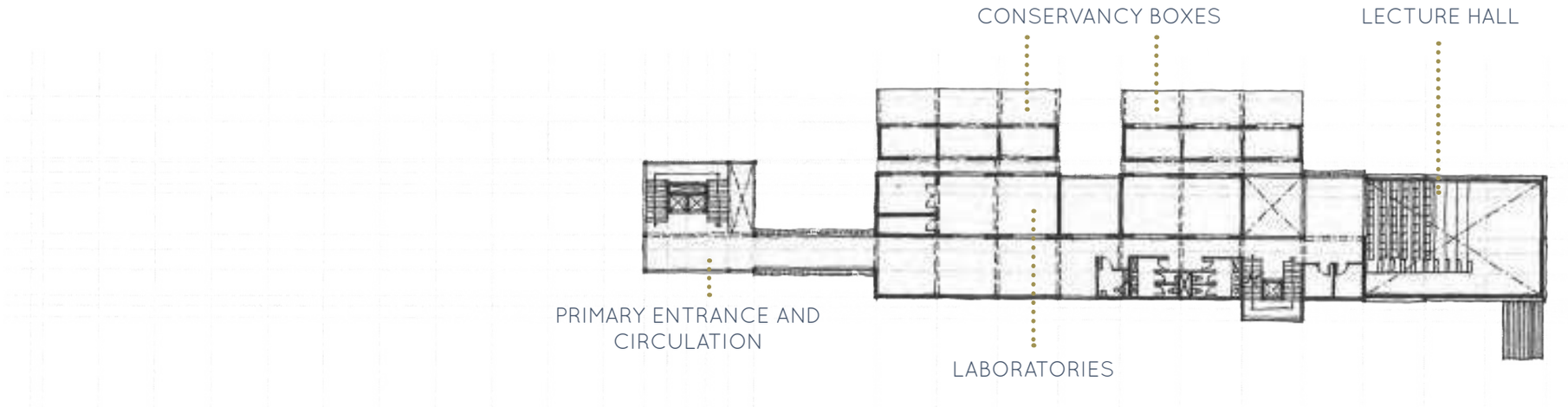
3.6 INCORPORATION OF TECHNICAL IMPLICATIONS



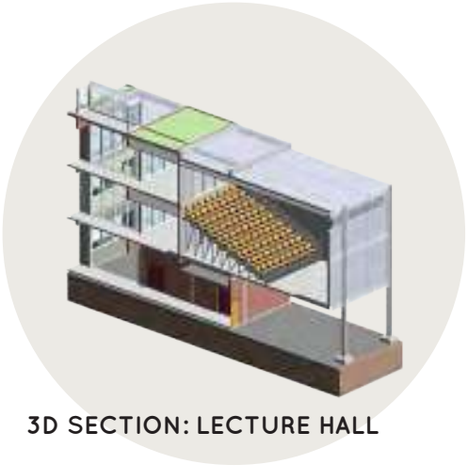
GROUND FLOOR PLAN



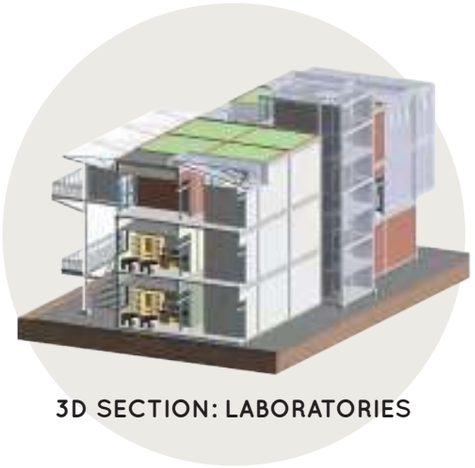
FIRST FLOOR PLAN



SECOND FLOOR PLAN



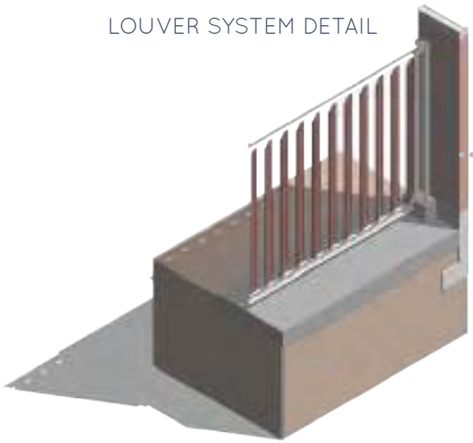
3D SECTION: LECTURE HALL



3D SECTION: LABORATORIES

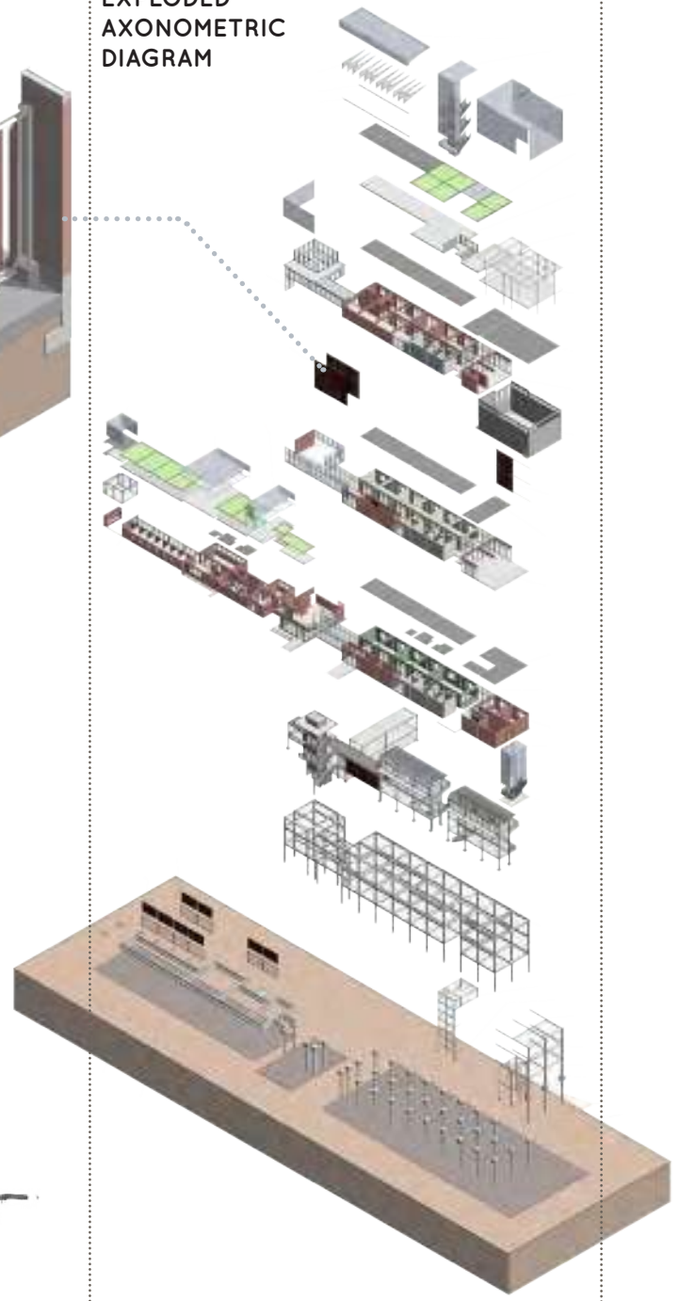
The materiality of the design proposal was selected from an understanding of the context, which consists predominantly of concrete framework buildings with brick infill and smaller load-bearing masonry structures. The materials chosen are intended to be textured where possible to contrast the smooth, sterile laboratory interiors.

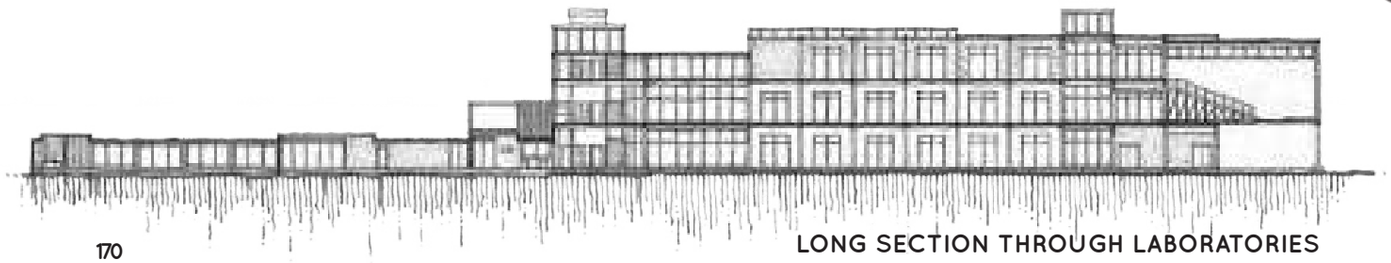
LOUVER SYSTEM DETAIL



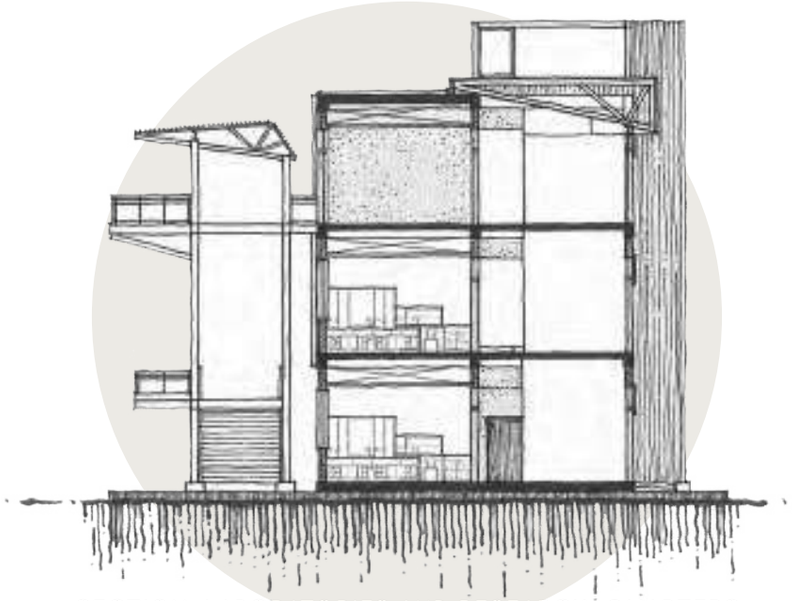
Developing the design in terms of the technical and structural requirements proved challenging as more practical considerations had to be made. The concrete framework proposed for the structural system had to be well insulated to suit the nature of laboratory work. At this stage, many of the spaces designed were too cramped and narrow for a conducive working environment. Furthermore, the design required additional fire escape routes and stairways, especially because it is a laboratory building where scientists may work with flammable substances and electrical equipment. Structural issue also arose from the design of canopies and overhangs that needed additional support.

EXPLODED AXONOMETRIC DIAGRAM





LONG SECTION THROUGH LABORATORIES



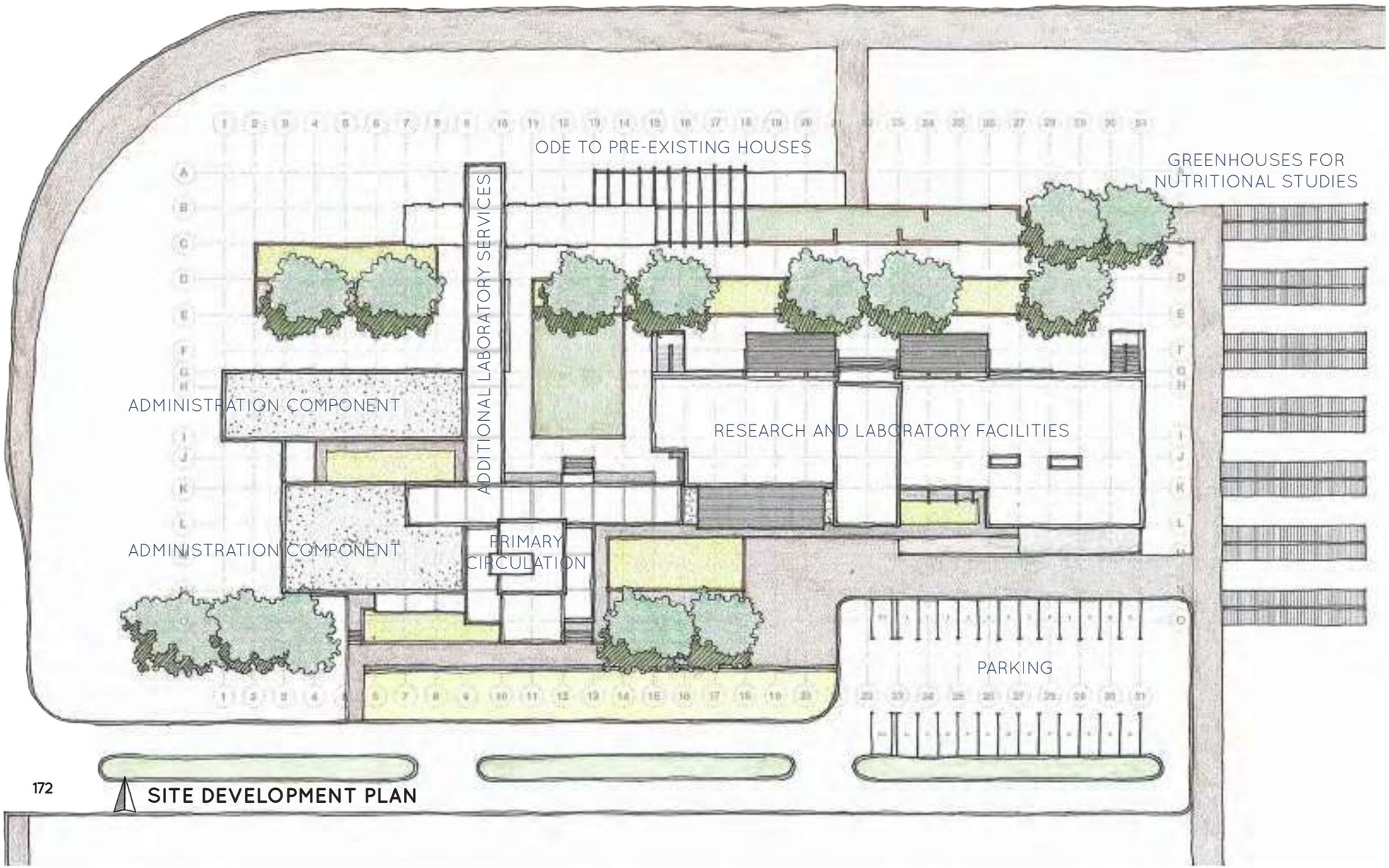
SECTION: LABORATORIES AND RESEARCH QUARTERS

SECTION: PRIMARY CIRCULATION TOWER

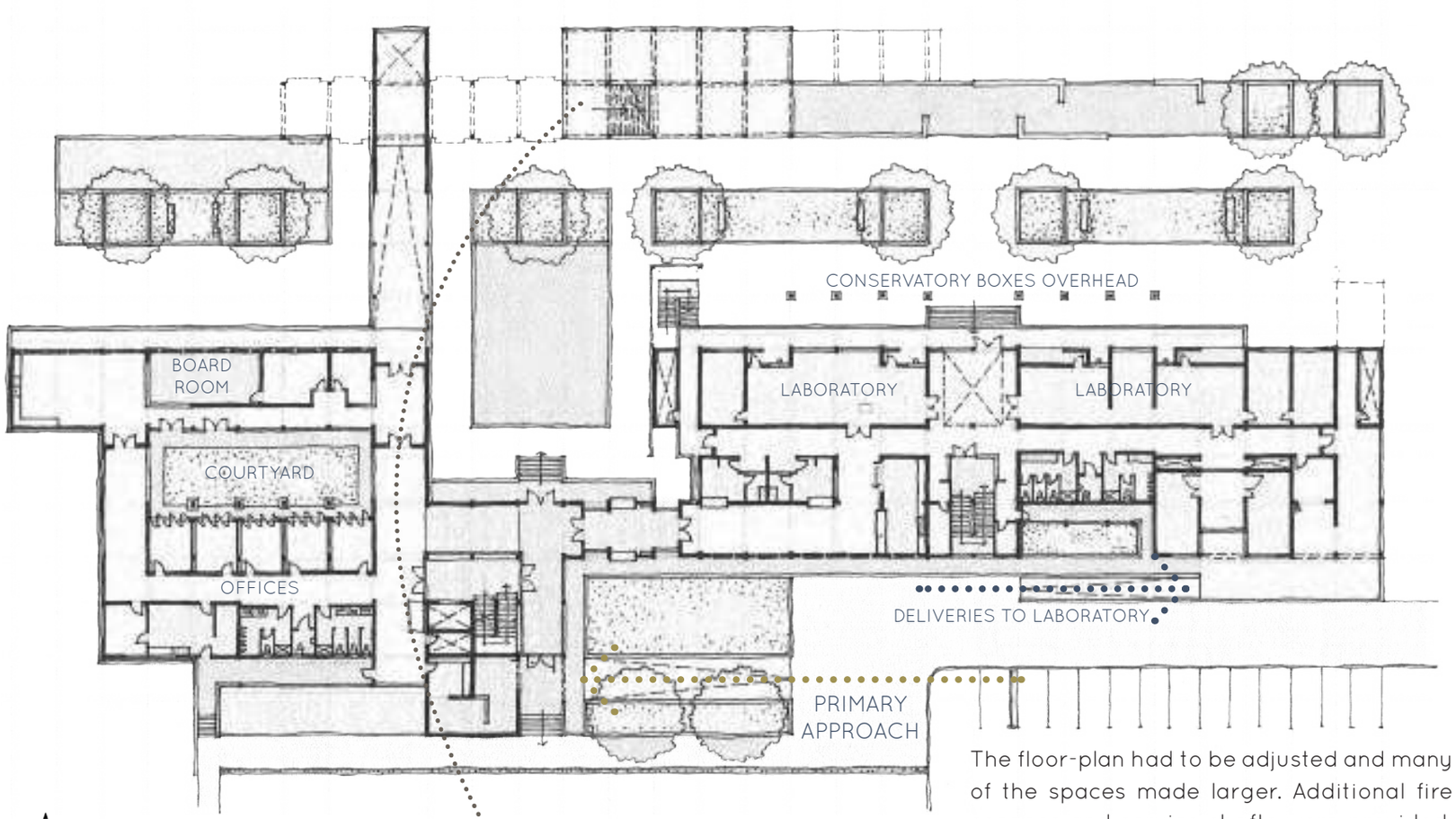
SECTION: ADMINISTRATION BUILDING

3D SECTION: ADMINISTRATION BUILDING

3.7 DEVELOPMENT OF THE TECHNICAL DESIGN



SITE DEVELOPMENT PLAN

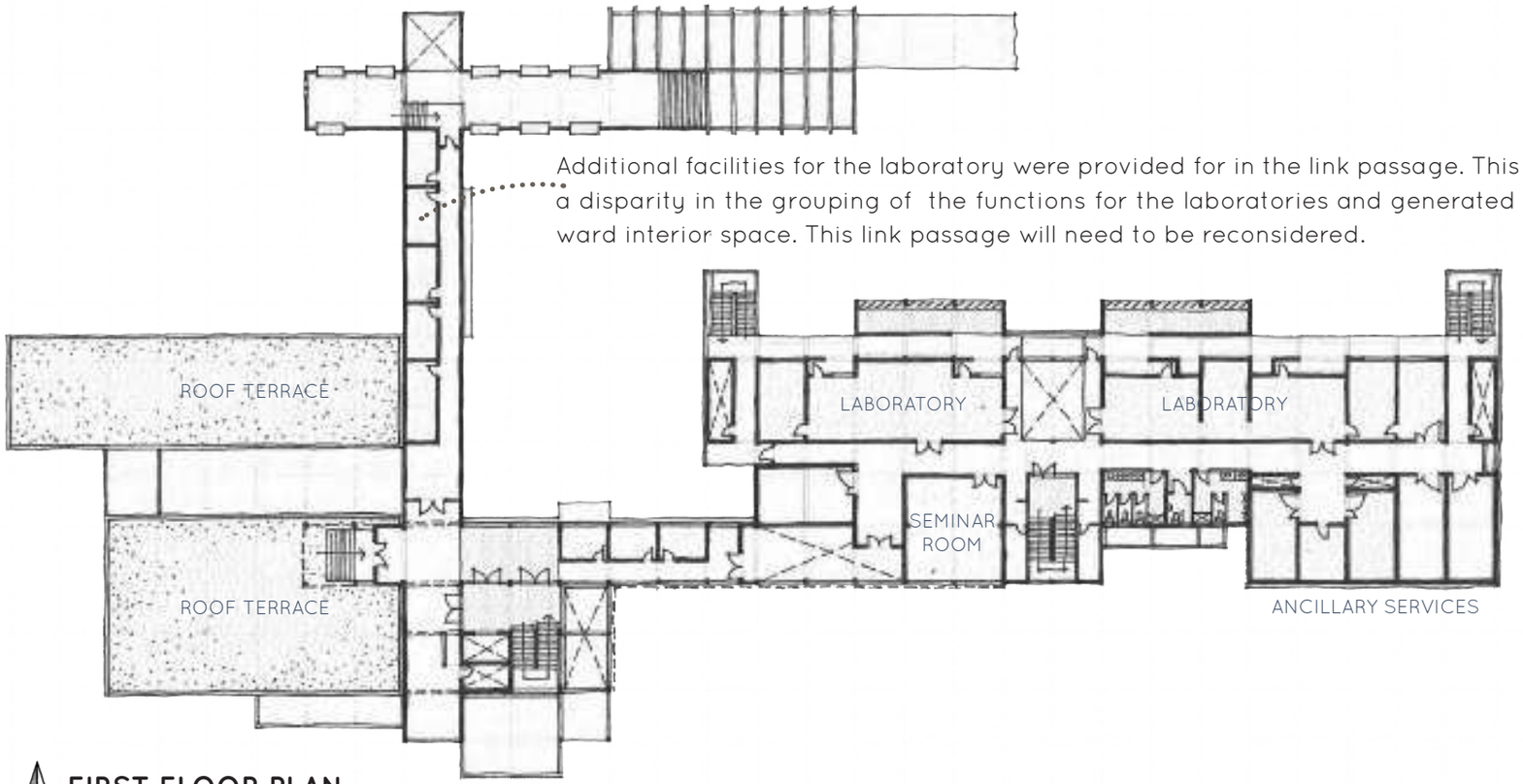


GROUND FLOOR PLAN

The floor-plan had to be adjusted and many of the spaces made larger. Additional fire escapes and service shafts were provided, and a courtyard provided for the administration block. Therefore, the plan has lost much of its original linearity.

The structures that allude to the memory of the houses on the site need to be dematerialised more as they are still too monolithic. Their development needs to be extended so that they can form a means of security for the laboratory and research facilities without having to put up a physical fence.

DEVELOPMENT OF EXTERIOR SPACES:
an ode to the structures that once were

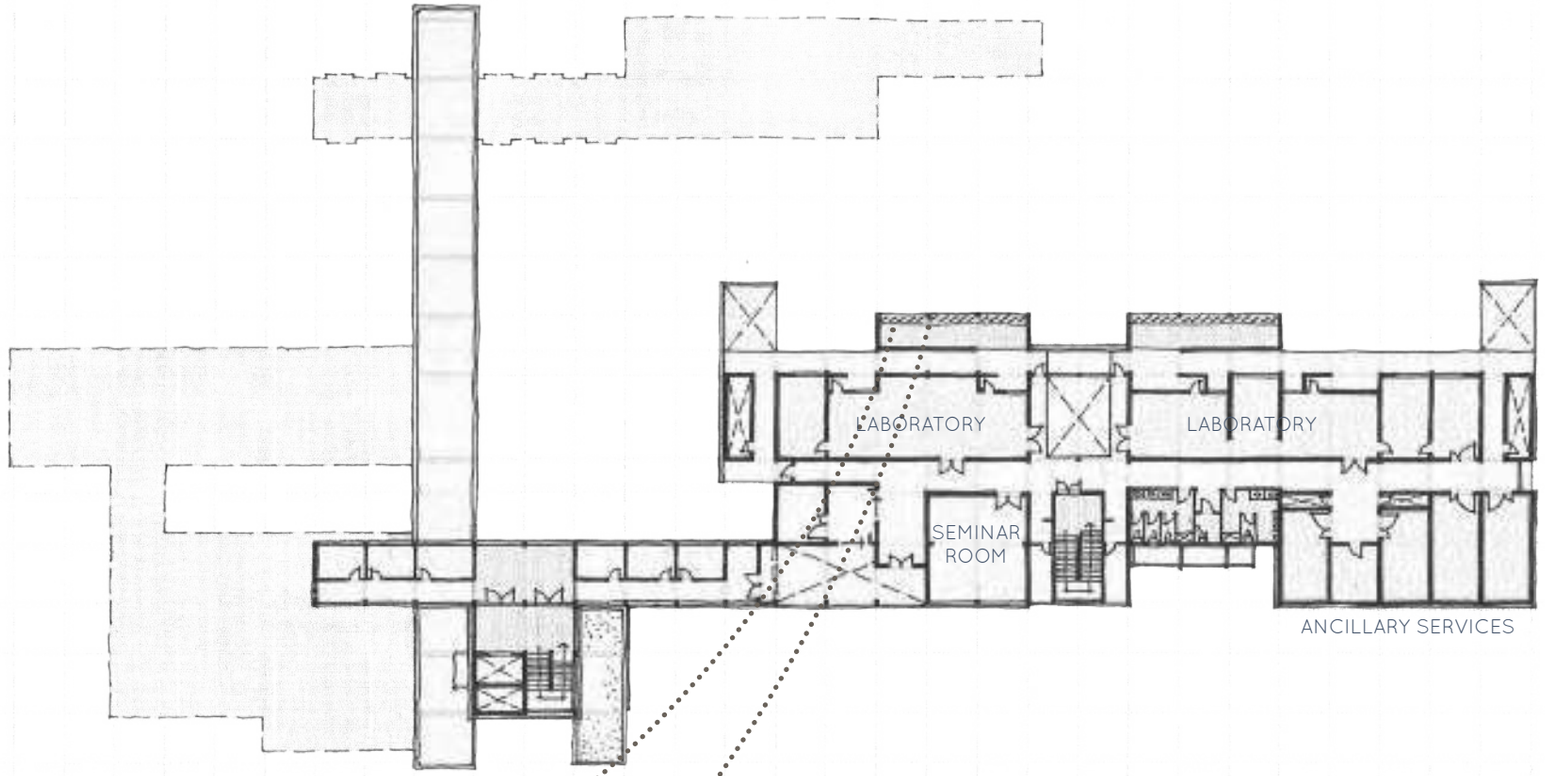


Additional facilities for the laboratory were provided for in the link passage. This created a disparity in the grouping of the functions for the laboratories and generated an awkward interior space. This link passage will need to be reconsidered.

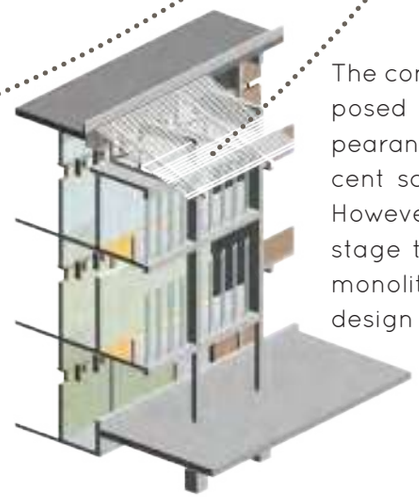
FIRST FLOOR PLAN

Initially, the brick infill walls were placed in between the concrete framework. This also needs to be reconsidered as it not only makes the structure very heavy, but creates too much of a rigid and repetitive aesthetic whereby openings are merely punctured into walls.

SOUTH ELEVATION

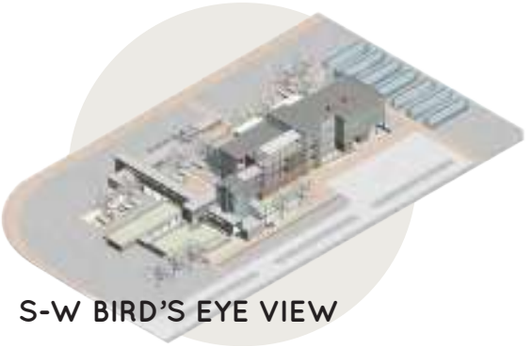


SECOND FLOOR PLAN

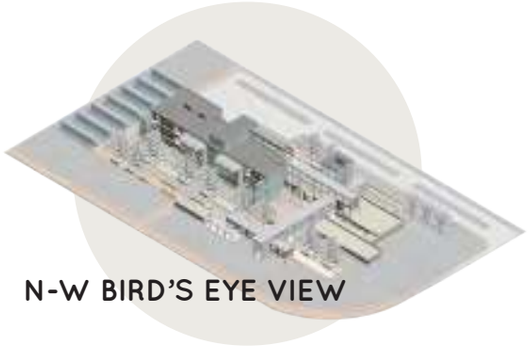


The conservatory boxes are supposed to be lightweight in appearance and act as a translucent screen to the laboratories. However, as designed at this stage they were too heavy and monolithic and did not meet the design intentions.

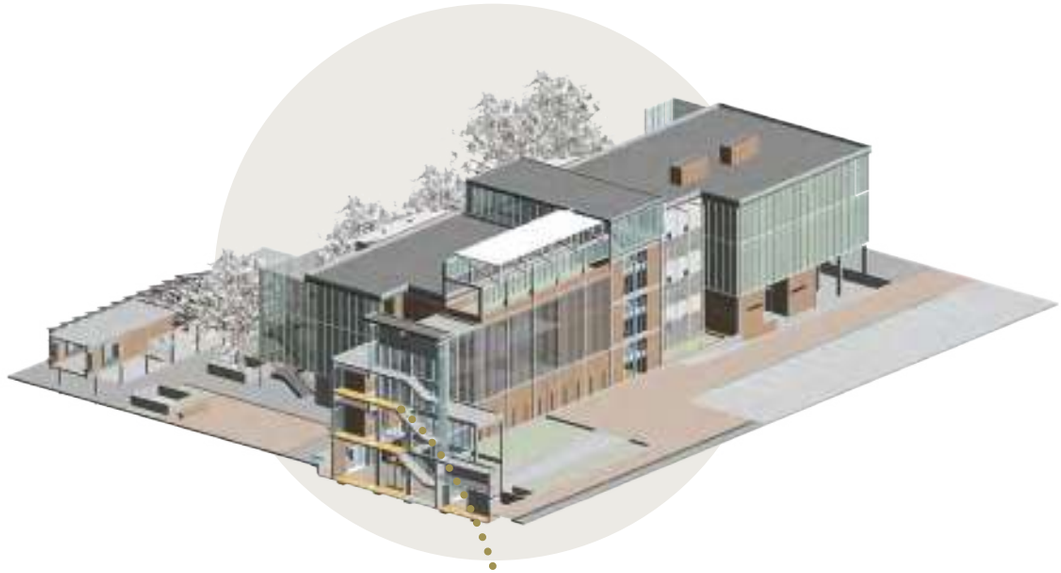
MAIN APPROACH FROM PARKING AREA

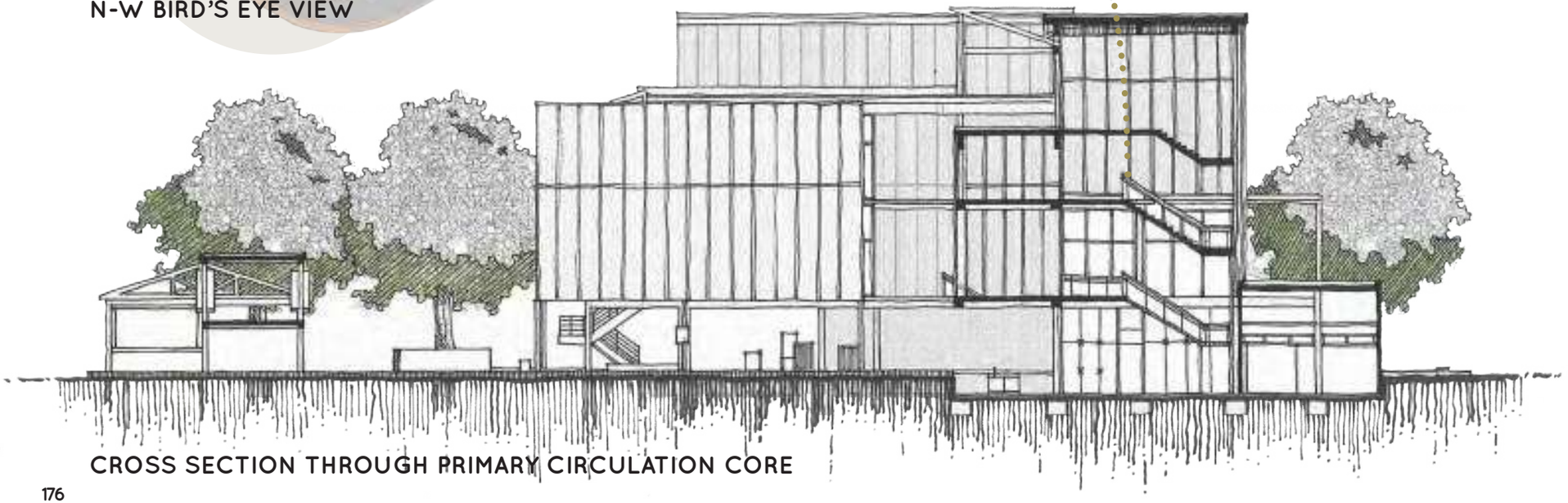


S-W BIRD'S EYE VIEW



N-W BIRD'S EYE VIEW

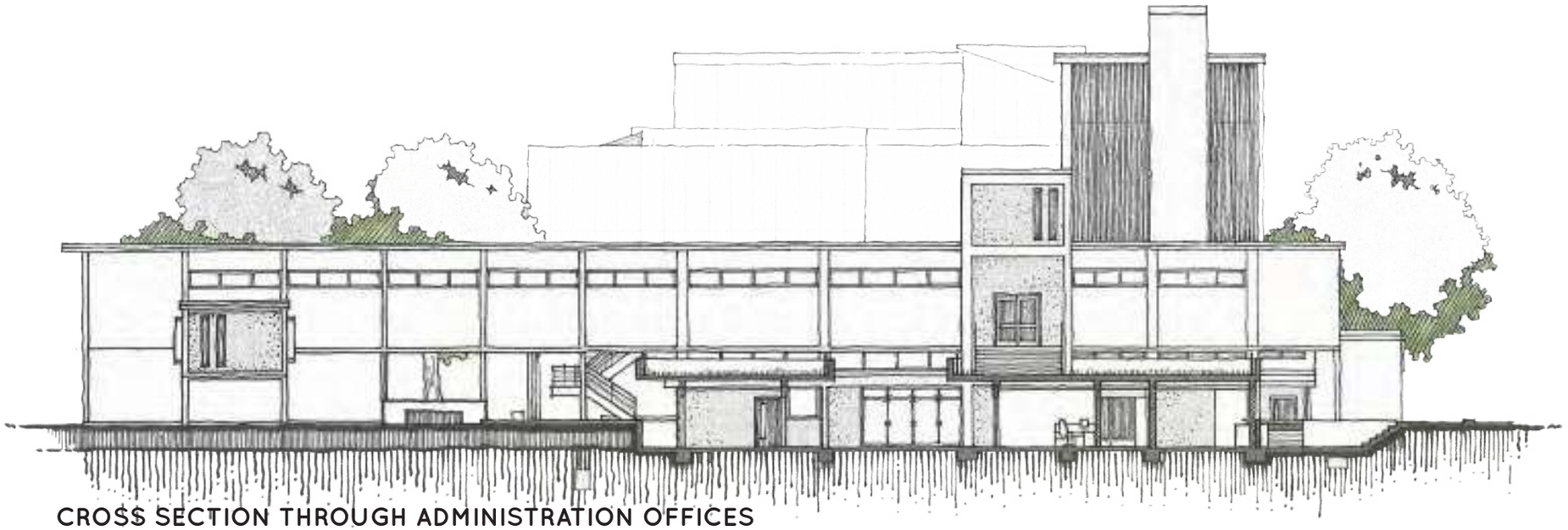




CROSS SECTION THROUGH PRIMARY CIRCULATION CORE

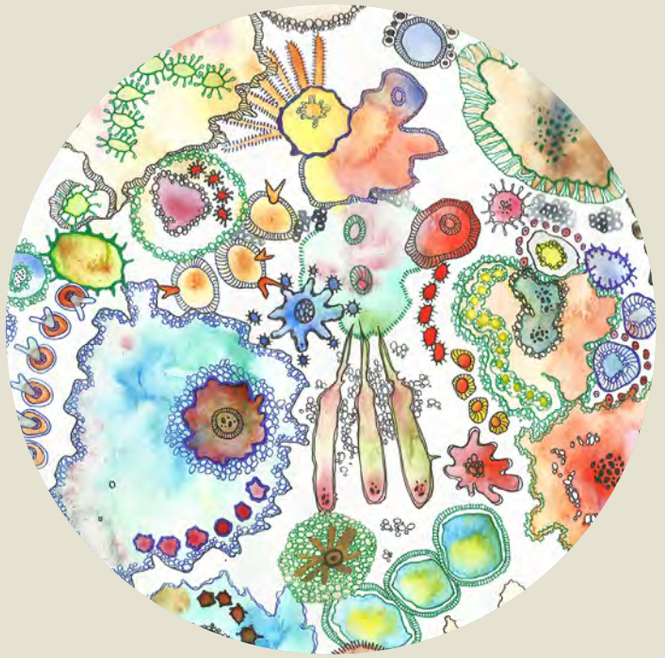
3D LONGITUDINAL SECTION

Exterior spaces need to be designed and developed further and should communicate with the building. The exterior development can designed from the order and proportions of spaces on plan, as well as the openings seen in elevation.



CROSS SECTION THROUGH ADMINISTRATION OFFICES

3.8



REVEALING THE INVISIBLE: TOWARDS THE FINAL DESIGN PROPOSAL

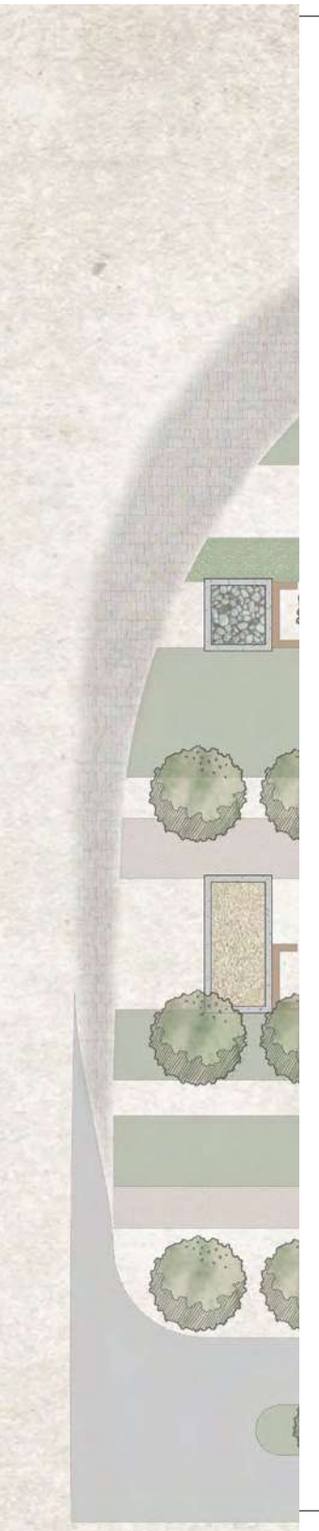
LIST OF PERMANENT USERS FOR THE INSTITUTE:

1 x RECEPTIONIST
1 x SECURITY OFFICER
5 x ADMINISTRATION AND OFFICE STAFF
5 x MAINTENANCE STAFF
1 x SECRETARY
1 x OFFICE MANAGER
1 x DIRECTOR
1 x TECHNICAL MANAGER
12 x SCIENTIFIC RESEARCHERS

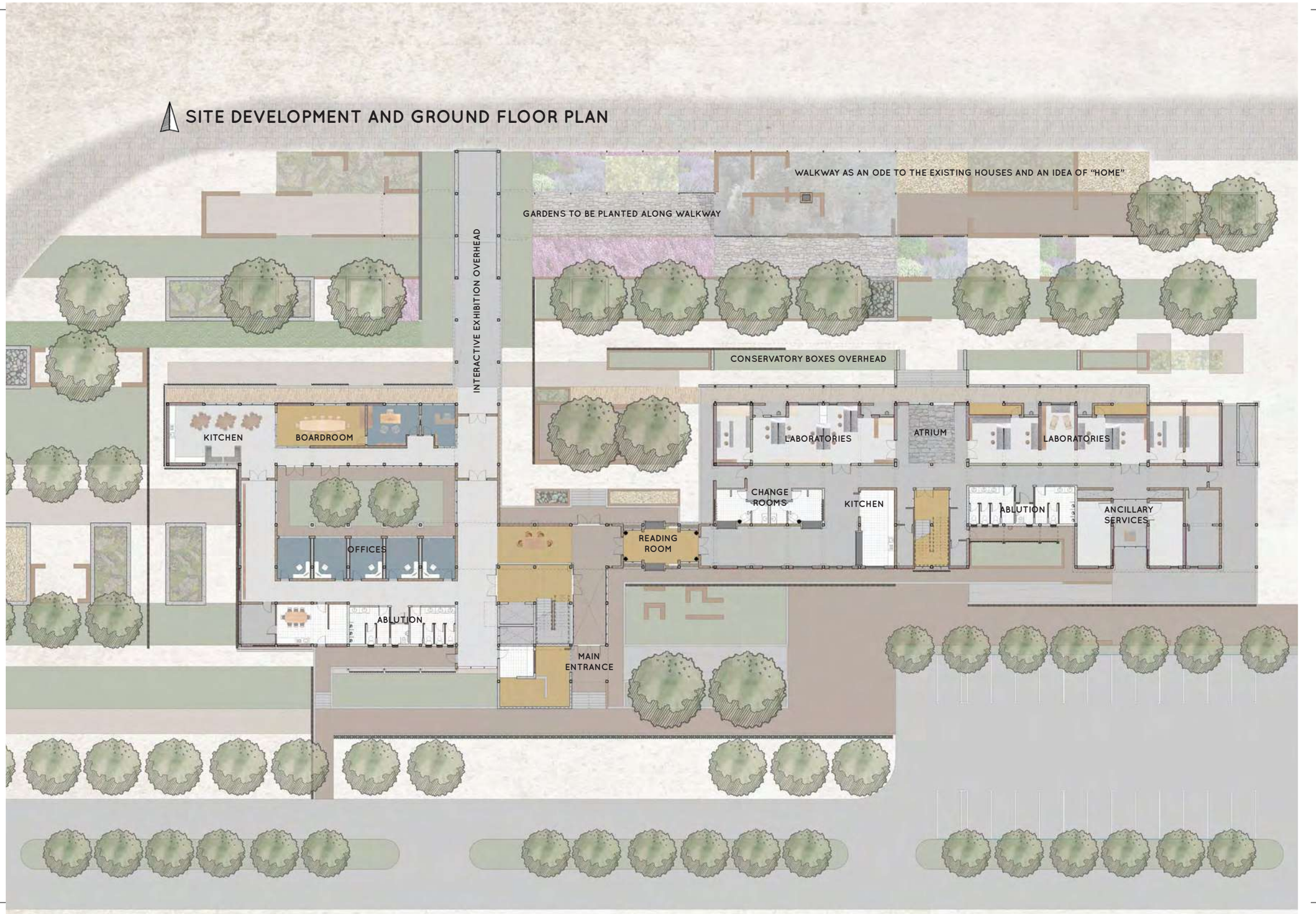
The Institute is also able to accommodate 5 post-graduate students who require its facilities to conduct research. They are not permanent users, however, as such an arrangement will be made with the director.

Visits to the institute can also be arranged for school children and other educational groups. Additionally, the interactive display, which consists of the "Epidemic Education Exhibition" can be frequented by members of the public on a more informal basis.

The staff seated in the administration offices will also have arranged meetings with heads of different groups and councils, such as community leaders, to provide information and counseling with regard to disease control and awareness.



SITE DEVELOPMENT AND GROUND FLOOR PLAN

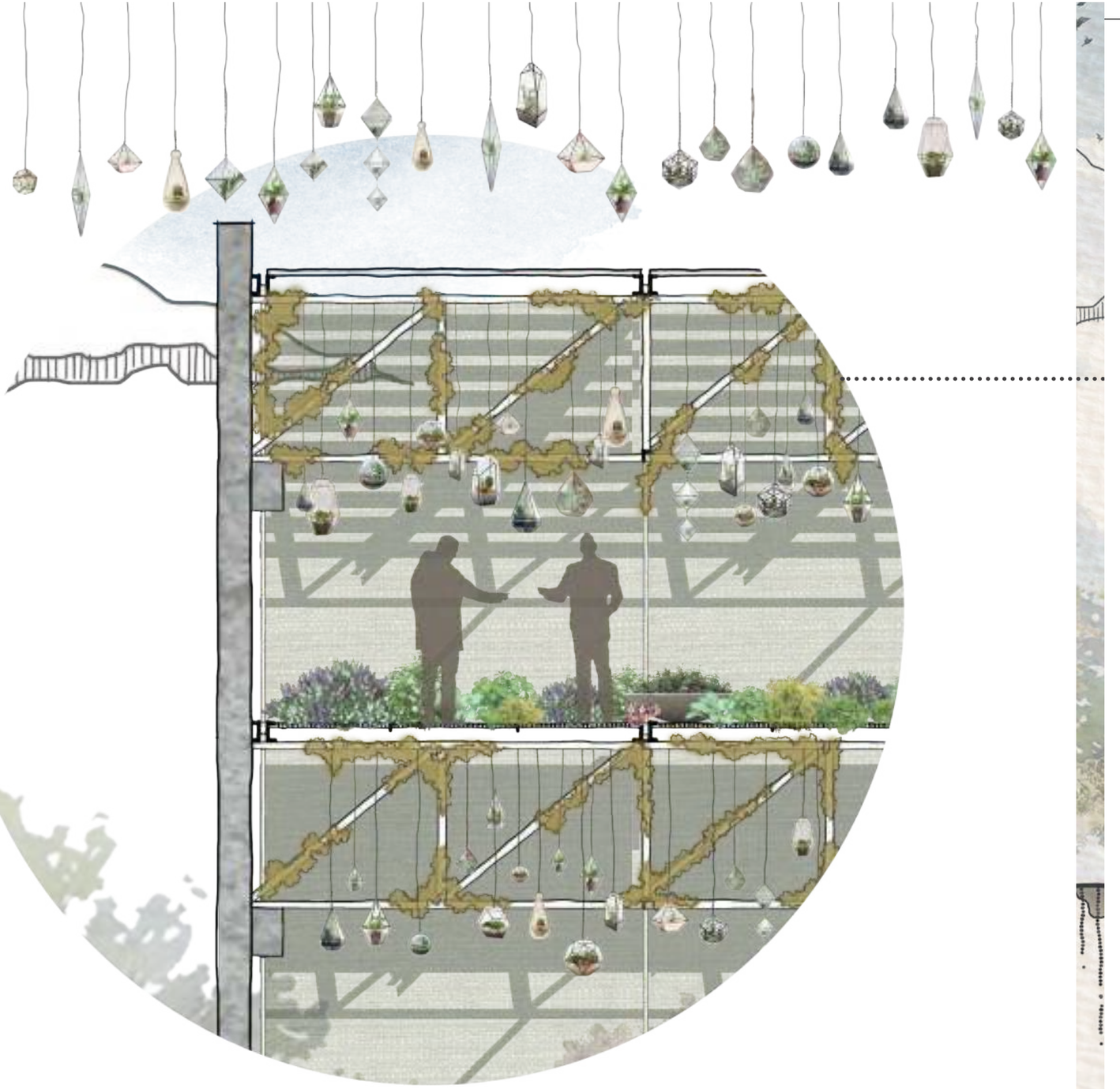


FIRST FLOOR PLAN

SECOND FLOOR PLAN

The conservatory spaces, deemed too monolithic in the previous stage of design, were therefore made “lighter” and more tectonic. A concrete wall supports steel Howe trusses on either side of the structure. Lightweight steel channels are used as additional support beams, on which steel grating provides a platform on which to stand.

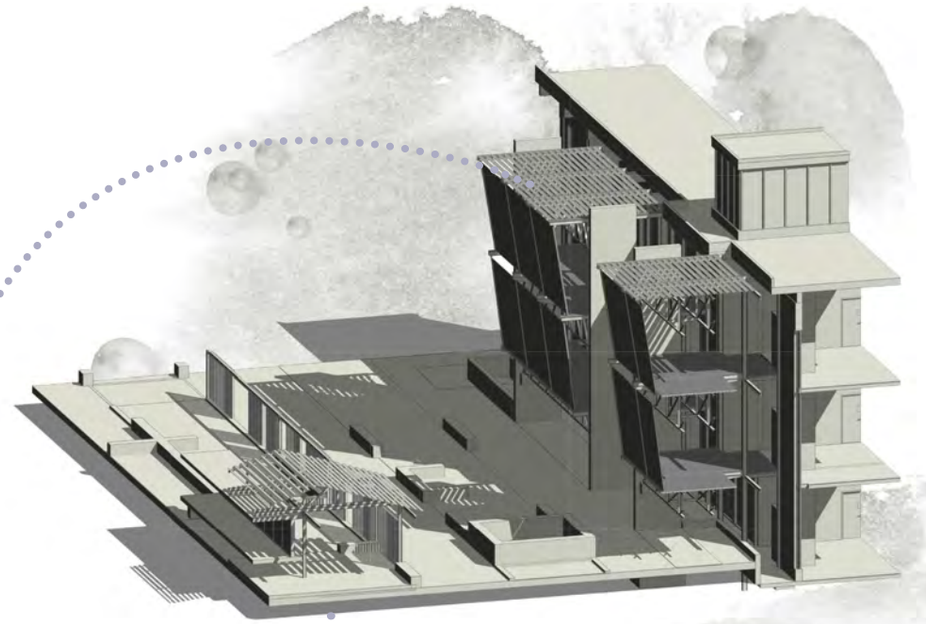
The intention is that these conservatories provide not only a place for plants that need to be researched to grow in close proximity to the laboratories, but also a place of relief and prostration for the scientist. These spaces become the “alchemist’s lair”, wherein the scientist - a keeper of specialised knowledge - can go to remove him or herself from the laboratory interior. From ground level, outside the confines of the laboratory, these structures can also be visually appreciated by the passer-by. These elevated conservatories are covered by a system of louvers overhead, and shade-netting along the vertical plane. The shade-netting is intended as the translucent material that makes the object behind it discernible but not entirely visible. Therefore, some of that which was previously completely hidden can be revealed.



LONGITUDINAL SECTION THROUGH A CONSERVATORY “BOX”

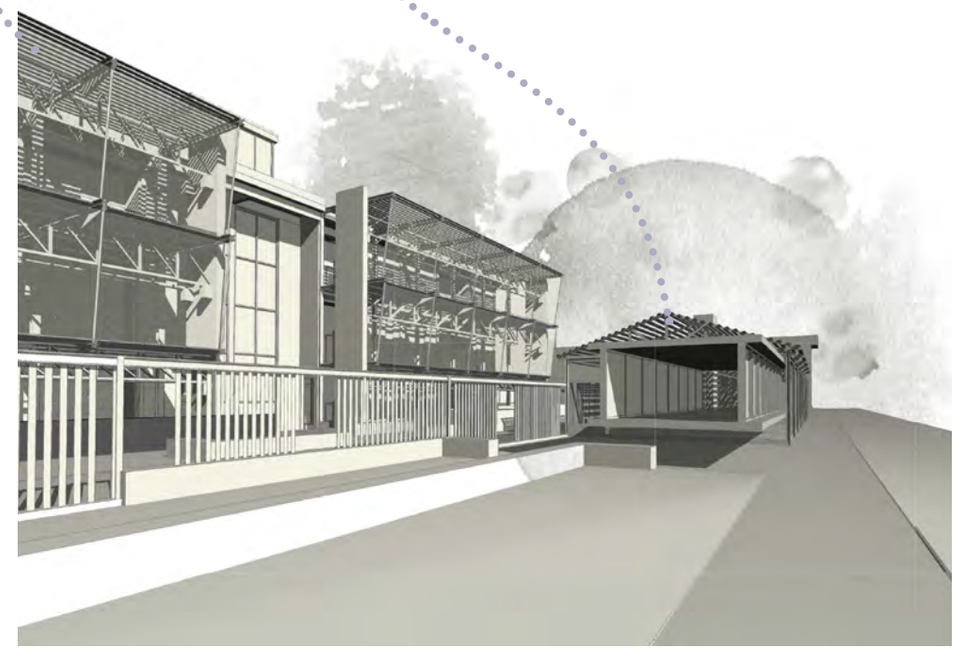
The exterior spaces still require a great deal of design and development. The ultimate intent is that the walkway proposed as an ode to the memory of the houses that existed on site can be linked and form part of a community garden that essentially lines the north-facing sidewalk. Lavender, rosemary and other "sturdy" herbs can be planted, and in conjunction with certain architectural elements developed from the de-materialisation of the existing house, can assist in defining the site as well as engendering public interest.

The gardens can be viewed from the conservatory boxes, establishing a visual connection focused on nature, notions of transience, and the inevitable effects of time. Additionally, the elements designed for the exterior development, such the masonry benches and low stone walls, create a further link to the *aesthetics of the ruin*, and contrast the serious and pristine laboratory environment, with the intent of finding balance between the requirements of a laboratory and the kind of spaces that are fundamentally enjoyed by people.



3D CROSS SECTION THROUGH LABORATORIES AND EXTERIOR SPACES

APPROACH ALONG NORTH-FACING SIDE WALK ON SITE



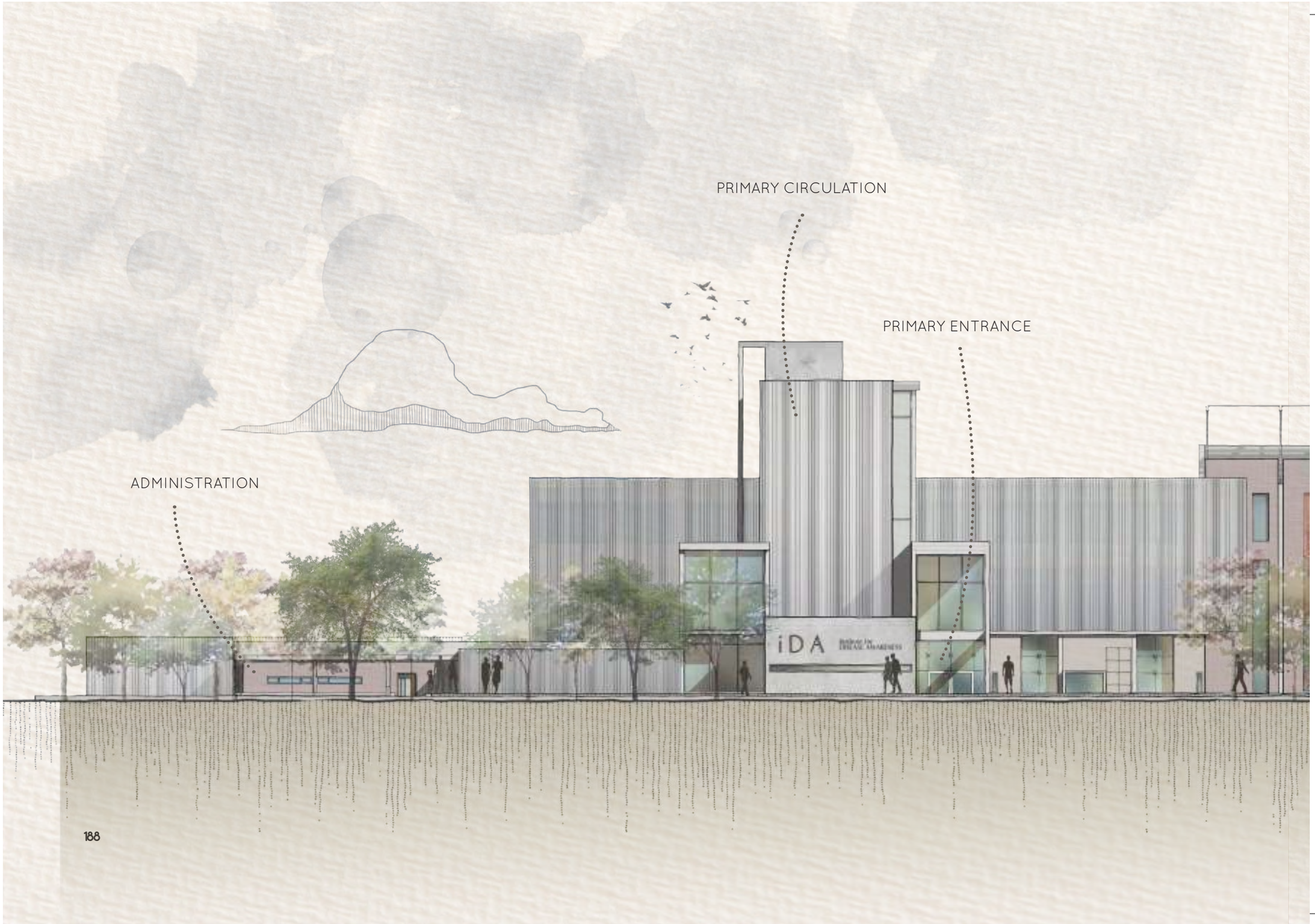
VIEW FROM UNDERNEATH CONSERVATORY “BOX”

Even though the proposed Institute is not an all-round public building, the initial aims focused on creating a public interest with regard to the microscopic world of disease. By fostering interest and a sense of curiosity, awareness about diseases and what can be done to combat their effect on the lives of human beings can be seen as an eventual result.

The laboratory functions that were housed in the link passage in a previous stage of the design development were moved back to the research and laboratory facility building, and the passage made an exhibition space. The exhibition is entitled the "Epidemic Education Exhibition" and consists of interactive displays. This space then acts as an intermediate phase between the public side walk and the private laboratory and office components of the Institute.

The interactive exhibition includes continually updated world maps displaying where disease epidemics are occurring with LED displays that can be adjusted and configured by participants. Antique microscopes and other equipment showing the development of microbiology and biochemistry throughout history is also put on display. Furthermore, imagery captured by the electron-microscopes from the laboratory are put on display and regularly updated. These same images of diseases and other microorganisms captured at a larger-than-life scale are projected across the exhibition space and out onto the sidewalk, relating these minute creatures to our own human world. In the same way that the touchstone created at the very beginning of the design process expressed the magnitude of the world of disease, this exhibition is intended to essentially ***reveal the invisible***.

THE EPIDEMIC EDUCATION EXHIBITION


PRIMARY CIRCULATION
PRIMARY ENTRANCE
ADMINISTRATION
iDA

SOUTH ELEVATION

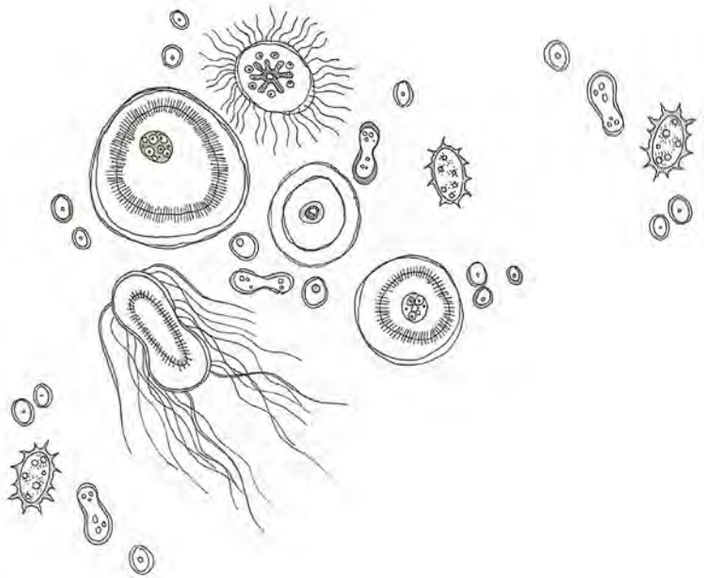
PART 4

EVALUATION AND REFLECTION

The following evaluation of the project is written from a personal point of view, as an individual reflection of the development of the project proposed in this dissertation. It is intended that this reflection focuses on the process of the design as well as the resultant challenges brought about by the process, and aims to serve as a concluding explanation of how the decisions with regard to these challenges informed the final design proposal.

As much as the site chosen for this project presented certain opportunities to unite a disparate context, and revitalise the space previously used for the golf-course, the existing structures on the site and the decisions around how to handle them presented definite problems and challenged the process of design. Initially, I wanted to keep all of the existing structures on the forefront of the golf-course and place the new Institute for Disease Awareness behind them. However, after further analysis of the site, and the way in which it is closed off from any public interface, I decided that the removal of the existing corner building (and its fences) would better facilitate a sense of interaction with pedestrians that pass the site. At this point, I was still at odds with what to do with the five existing houses that lined the front of the site. These houses are unused and are of no immense historical significance, yet communicated, at least personally, some sense of the past of the context, and allude to its present transitional nature. An intuitive sense perceived them as a means of finding a balance between the residential and institutional nature of the context – a way of introducing something new (i.e. the proposed Institute) while retaining a sense of the familiar. Nonetheless, if one looks at the project through the eyes of a developer, it becomes difficult to see the value in retaining these structures, especially when considering the prospect of future developments following the construction of the proposed Institute.

This stage of indecision in terms of how to handle the houses was reflected in the design process of the project. Therefore, a sense of incongruity is seen in the process – the nature of the early designs seem more detached from one another; in search of a solution through varying interventions that were somewhat distracted by these five houses. Ultimately, I decided then to retain the memory of the houses, rather than the structures themselves, so that I could still portray a sense of the context's past and convey something that was familiar to people living in this area, namely the morphology of the red-clay brick house, without detracting from the value of the project. I decided that the footprint of the house closest to the corner could provide a sense of order for the rest of the development and assist in facilitating a public interest: act as the intermediate phase between the activated public sidewalk and the more private, confined laboratories and research spaces provided by the new Institute. Therefore, this reference to the house as a place of comfort and familiarity is intended to contrast that which is somewhat unfamiliar to the everyday man, namely the scientific institute. The structure of the house was reinterpreted and deconstructed to bring forth an inclusion of natural elements, and portray a sense of the aesthetics of the architectural ruin – a more romanticised component that is intended to welcome people and evoke a sense of curiosity. From this one house, the rest are intended to be remembered as a walkway consisting of benches and landscaping. The objective is that this walkway can be utilised as a market space over specified periods when produce from the gardens is to be sold to the public, and add a sense of integrated value to future projects as this area is developed. In other words, the idea of that existing house becomes the container from which growth can occur, alluding to the growth of bacterial cultures in a Petri dish.



Another significant challenge presented by this site was its sheer size and the way in which parameters had to be personally decided. The lack of confines and objects or structures that divided the site into smaller components made determining the size of the proposed project somewhat difficult. Therefore, allocating the sizes of the functions that the new Institute provided was important as the formative factor for how big the Institute would ultimately be. The project had to be similar in size to the other institutions within the context, large enough to accommodate the requirements of this type of scientific research facility, and form a basis for the prospect of future developments along the newly repurposed golf-course. If it was designed too small, it disappeared within the expanse of the site as had happened with the existing structures before it, if made too large it presented itself as an "object" that landed in a foreign context.

As is with almost all architectural interventions of this nature, especially in the South African context, maintenance and security upon completion of the project will be the decisive factor in determining its success. As stated, the site was previously surrounded by a forked fence, and the intent of the new project's removal of this element is to allow the community some sense of ownership. By designing the community gardens as spaces of gathering that can be well-lit, surveyed, and maintained, the objective is that the site will not require security in the form of a fence. Nonetheless, this intent is wholly dependent on the client's ability to practice continued maintenance, which I believe to be good. I do not want to foresee the failure of this aspect – design as a process is an idealistic progression. One has to believe that somewhere along the line, an idea will work out; that architectural interventions do not have to be approached from a point of view surrendered to ideas of crime and vandalism.

The proposed Institute for Disease Awareness becomes a means for highlighting the intense and complex relationship between human beings and the countless microorganisms that surround us and continually influence our existence. It is intended as an intervention that provides a way of understanding, an opportunity for education, and a chance at teaching the broader community how to defend themselves against disease by providing access to adequate nutrition and fresh produce. This Institute and the specific design intentions with which it was conceptualised is a way for architecture to reinforce the relationship between the scientist, the keeper of specialised knowledge; the everyday person who needs to realise the impact of "the invisible" on his or her life; and the forces of nature which stands as the uniting factor between these two groups and the microscopic world of disease.

BIBLIOGRAPHY

Boring, E. G. 1964. Cognitive dissonance: Its use in science. *Science: New Series* [online], 145(3633), pp. 680-685. Available through: JSTOR Archive <http://www.jstor.org/stable/1713761> [Accessed 17 June 2015].

Burrows, E. H. 1958. *A history of medicine in South Africa up to the end of the nineteenth century*. Cape Town: Balkema.

Ching, F. D. K. 2008. *Building construction illustrated*. New Jersey: John Wiley & Sons.

Coetzer, N. 2007. Icon. Symbol. Glue: the University of Cape Town's Institute of Infectious Disease and Molecular Medicine. *Architecture South Africa: Journal of the South African Institute of Architects*, January/February 2007, pp. 34-37.

Coetzer, N. 2007. The good architect is a mad Masai scientist: Biocav Vaccine Laboratory. *Architecture South Africa: Journal of the South African Institute of Architects*, July/August 2007, pp. 86-89.

Cohen, J. 2000. Designer labs: architecture discovers science. *Science: New Series* [online], 287(5451), pp. 210-214. Available through: JSTOR Archive <http://www.jstor.org/stable/1713761> [Accessed 4 May 2015].

Colomina, B. 2008. X-ray architecture: illness as metaphor. *Positions*, pp. 30-35.

Curl, J. S. 2003. *Classical architecture: an introduction to its vocabulary and essentials, with a select glossary of terms*. New York: W. W. Norton & Company.

De Beer, P. 2014. Institute of Infectious Diseases and Molecular Medicine Link Building. In: Heroldt, A., ed. 2014. *Architectural conservation in South Africa since 1994: 100+ projects*. Port Elizabeth: DOT Matrix Publications. pp. 90-93.

Deckler, T., Graupner, A., Rasmuss, H. 2006. *Contemporary South African architecture in a landscape of transition*. Cape Town: Double Storey Books.

Del Rio, E. 1993. Review of Vidler's The architectural uncanny. *Discourse* [online], 15(3), pp. 177-181. Available through: JSTOR Archive <http://www.jstor.org/stable/41389291> [Accessed 4 April 2015].

Dingaan, M. N. V. & Du Preez, P. J. 2013. Grassland communities of urban open spaces in Bloemfontein, Free State, South Africa. *Koedoe*, 55(1), pp. 4-8.

Ginsberg, R. 2004. *The aesthetics of ruins*. Amsterdam: Radopi.

Harries, K. 1998. *The ethical function of architecture*. Massachusetts: MIT Press.

Impuls Centrum, 2000. *Spatial transformation in post-apartheid South Africa*. [online]. Available at: <https://www.impulscentrum.be/south_africa/Mod3_city/lesson11.asp> [Accessed 14 March 2015].

Johnston, G. B. 1988. Architecture and alchemy. *Journal of Architectural Education* [online], 41(2), pp. 10-20. Available through: JSTOR Archive <http://www.jstor.org/stable/1424830> [Accessed 10 June 2015].

Jones, M. W. 1990. The tempietto and the roots of coincidence. *Architectural History* [online], 33, pp. 1-28. Available through: JSTOR Archive <http://www.jstor.org/stable/1568546> [Accessed 20 March 2015].

LabNetwork, 2009. *Microbiology lab: design, development and layout*. [online]. Available at: <http://www.labnetwork.org/en/microbiology-lab/114-design-development-and-layout> [Accessed 16 April 2015].

Lambert, L. 2014. *#Weaponized architecture /// disease vs. spatial segregation: "quadrillage" quarantine vs. siege quarantine*. [online]. Available at: <http://thefunambulist.net/2014/09/01/weaponized-architecture-disease-as-spatial-segregation-quadrillage-quarantine-vs-siege-quarantine/> [Accessed 28 February 2015].

Leslie, S. W. 2008. A different kind of beauty: scientific and architectural style in I. M. Pei's Mesa Laboratory and Louis Kahn's Salk Institute. *Historical Studies in the Natural Sciences* [online], 38(2), pp. 173-221. Available through: JSTOR Archive <http://www.jstor.org/stable/10.1525/hsns.2008.38.2.173> [Accessed 5 April 2015].

Medical Research Council (MRC) South Africa, 2010. *Cause of death statistics for South Africa: challenges and possibilities for improvement*. [pdf] MRC Burden of Disease Research Unit. Available at: <http://www.mrc.ac.za/bod/cause_death_statsSA.pdf> [Accessed 1 march 2015].

Neoro, J. 2013. Productive infrastructure. *Architecture South Africa: Journal of the South African Institute of Architects*, July/August 2013, pp. 16-17.

Neufert, E. 1970. *Architect's data*. London: Crosby Lockwood & Son.

Newman, W. R. 2011. What have we learned from the recent histiography of alchemy? *Isis* [online], 102(2), pp. 313-321. Available through: JSTOR Archive <http://www.jstor.org/stable/10.1086/660140> [Accessed 17 June 2015].

Newman, W. R. and Principe, L. M. 1998. Alchemy vs. chemistry: the etymological origins of a historiographic mistake. *Early Science and Medicine* [online], 3(1), pp. 32-65. Available through: JSTOR Archive <http://www.jstor.org/stable/4130048> [Accessed 17 June 2015].

NHLS, 2015. *National Institute for Communicable Disease, division of the National Health Laboratory Service*. [online]. Available at: <http://www.nicd.ac.za> [Accessed 5 February 2015].

Peres, E. 2009. National tuberculosis reference laboratory. *Digest of South African Architecture*, 14, pp. 22-23.

Principe, L. M. 2011. Alchemy restored. *Isis* [online], 102(2), pp. 305-312. Available through: JSTOR Archive <http://www.jstor.org/stable/10.1086/660139> [Accessed 17 June 2015].

Redgrove, S. H. 1969. *Alchemy: ancient and modern*. London: University Books.

Robinson, P. and El Kaliouby, R. 2009. Introduction: computation of emotions in man and machines. *Philosophical Transactions: Biological Sciences* [online], 364(1535), pp. 3441-3447. Available through: JSTOR Archive <http://www.jstor.org/stable/40538137> [Accessed 25 June 2015].

Schmidt, S. (ed.). 2013. *Architective: building construction standards for South Africa*. Johannesburg: Architective Publications.

StudioMAS, 2007. *Public projects: Biovac Phase 1.* [online]. Available at: <http://www.studiomas.co.za/biovac-phase1.php> [Accessed 28 February 2015].

StudioMAS, 2009. *Public projects: NICD Laboratory.* [online]. Available at: <http://www.studiomas.co.za/nicd-laboratory.php> [Accessed 28 February 2015].

The Concrete Society. 1986. *Concrete detail design*. London: Architectural Press.

Tondeschino, M. 2007. New offices for the QC Laboratory for the Biovac Institute. *Digest of South African Architecture*, 12, pp. 104-105.

"touchstone." Merriam-Webster. 2015. *Merriam-Webster Dictionary*. [online]. Available at: <http://www.merriam-webster.com/dictionary/touchstone> [Accessed 2 March 2015].

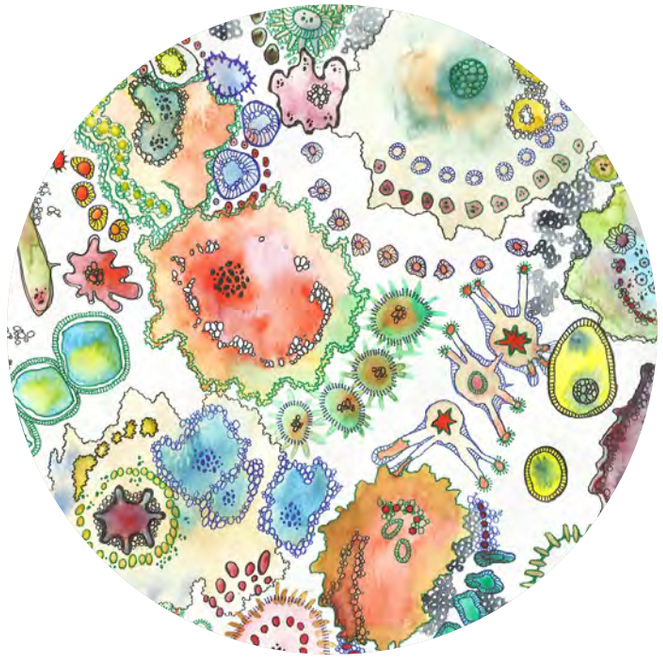
Unwin, S. 1997. *Analysing Architecture*. London: Routledge.

Vidler, A. 1992. *Essays in the modern unhomely*. Cambridge, Massachusetts: MIT Press.

Vidler, A. 1993. Spatial violence. *Assemblage* [online], 20, pp. 84-85. Available through: JSTOR Archive <http://www.jstor.org/stable/3181712> [Accessed 4 April 2015].

Wegelin, H. 2009. *Construction primer for Southern Africa*. Pretoria: Visual Books.

World Health Organisation. 2014. *World health statistics*. [online]. Available at: <http://www.who.int/mediacentre/news/releases/2014/world-health-statistics-2014/en/> [Accessed 1 March 2015].

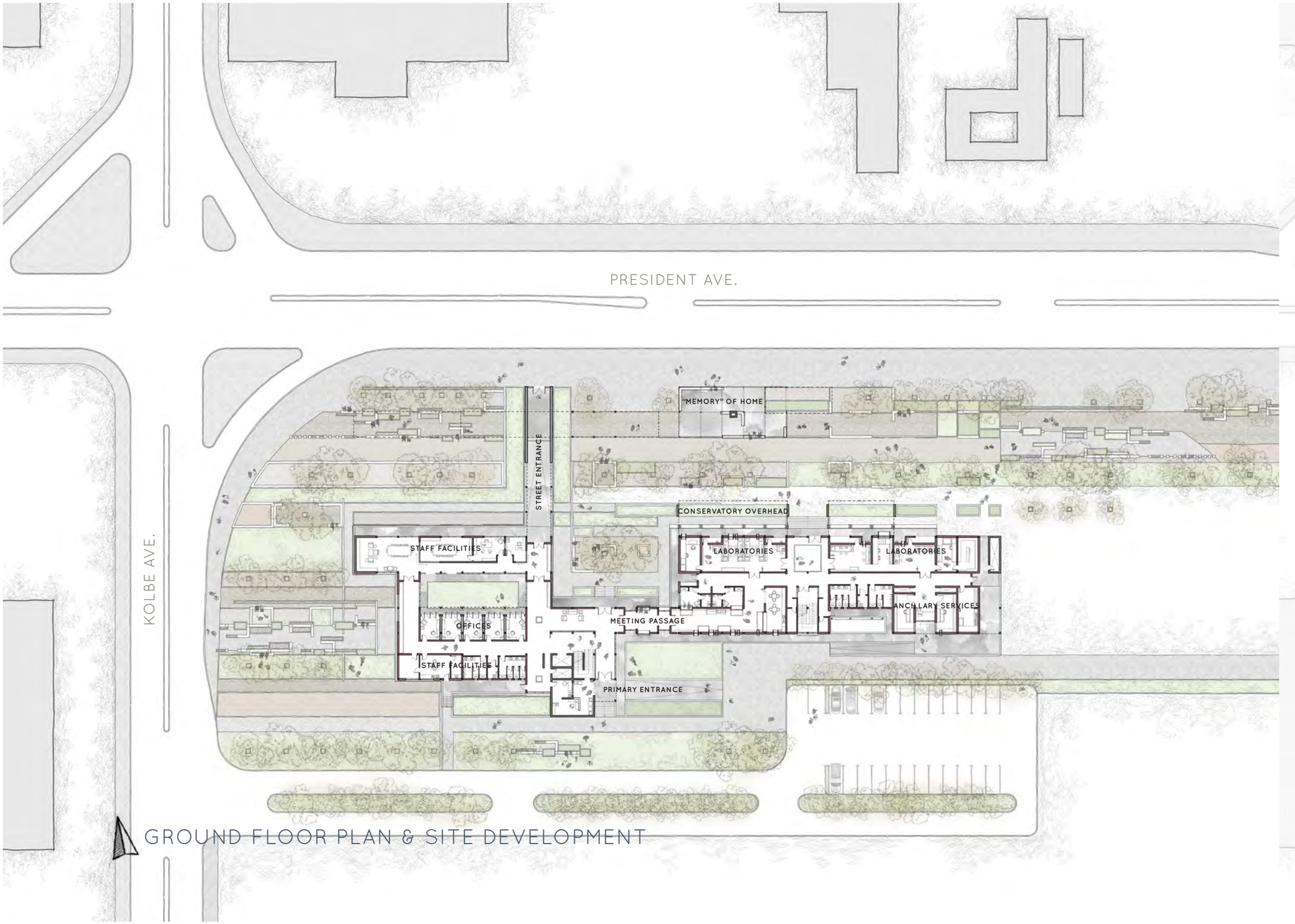


REVEALING THE INVISIBLE:

FINAL DESIGN PROPOSAL

INSTITUTE FOR DISEASE AWARENESS

APPROACH TO PRIMARY ENTRANCE FOR
STAFF AND VISITORS, FROM SOUTH-WEST

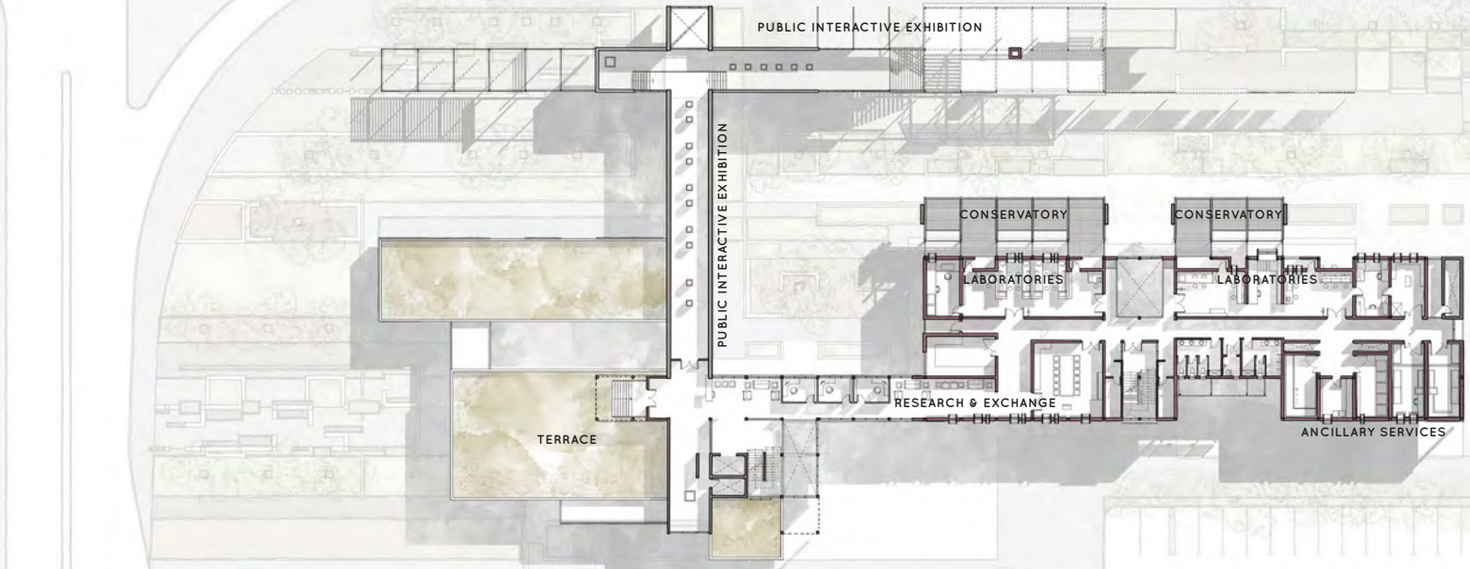


GROUND FLOOR PLAN & SITE DEVELOPMENT

ENTRANCE VIEW ONTO LOBBY

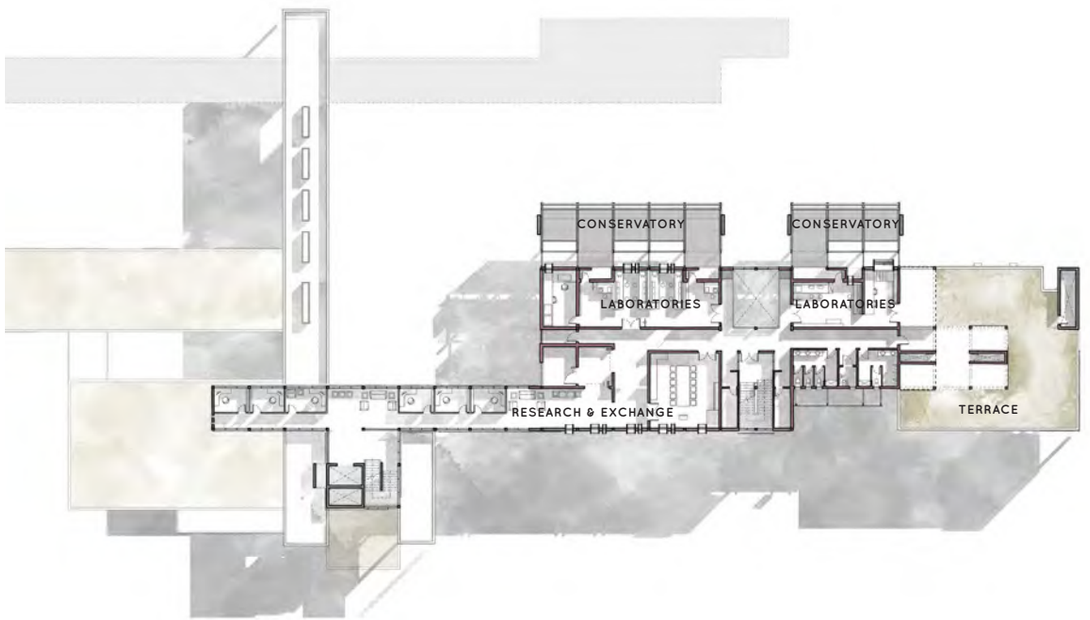
MEETING SPACE IN PASSAGE: INFORMAL GATHERING & INTERDISCIPLINARY INTERACTION

STAFF KITCHEN AND DINING SPACE



FIRST FLOOR PLAN

NORTH ELEVATION

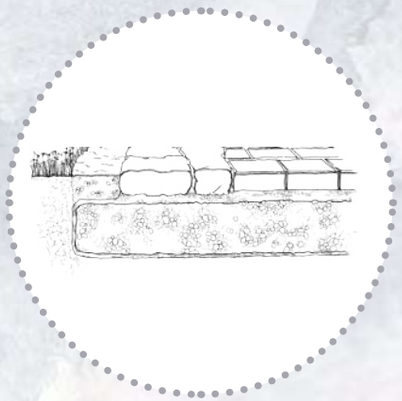


SECOND FLOOR PLAN

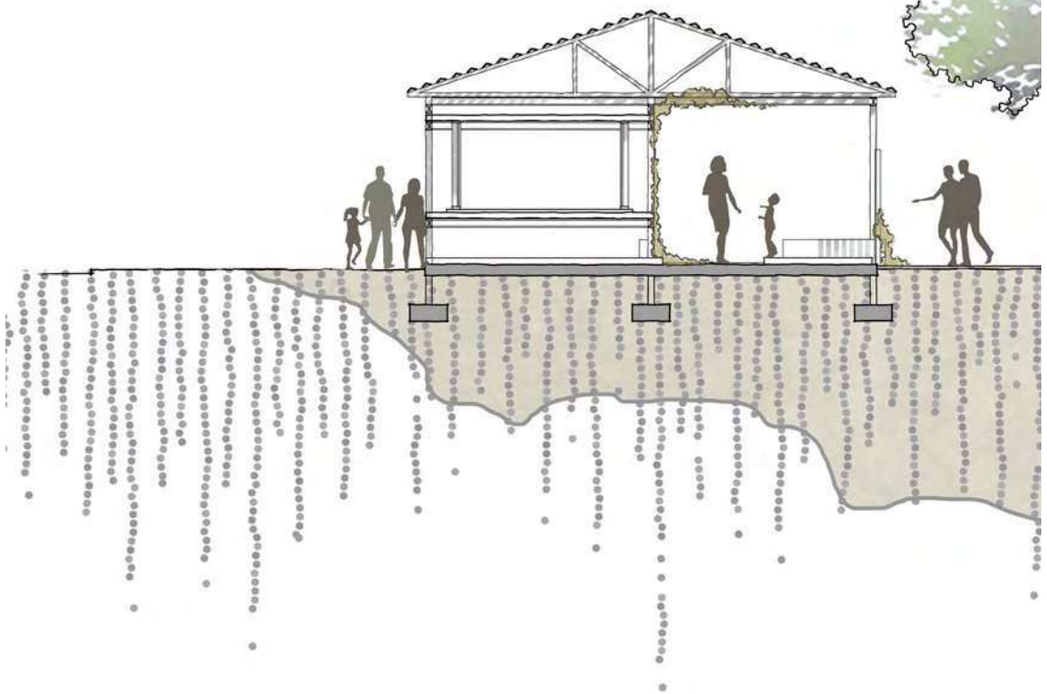
SOUTH ELEVATION

VIEW ONTO CORNER LOOKING SOUTH-EAST

PRIMARY ENTRANCE INTO THE INSTITUTE



The structure of the dematerilaised house stretches along the side walk, creating a walkway of low masonry and stone benches, planters, and sturdy gardens of indigenous and medicinal herbs and plants. Texture and material changes in paving evoke haptic qualities.



CROSS SECTION: ODE TO HOME - CONSERVATORY - LABORATORY

(LEFT TO RIGHT)

VIEW ONTO A CONSERVATORY:

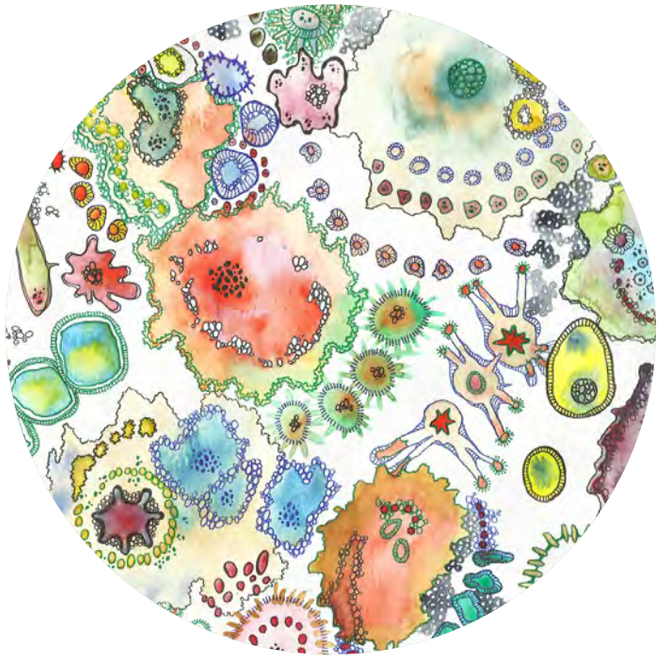
CREEPERS & CLIMBERS

Clematis brachiata
Traveler's Joy (Eng.)

Mondia whitei
White's Ginger (Eng.)
- medicinal properties

TEXTURES / MATERIALS / VISUAL GRADIENT

VIEW FROM UNDERNEATH CONSERVATORY
LOOKING ONTO THE PUBLIC GARDENS



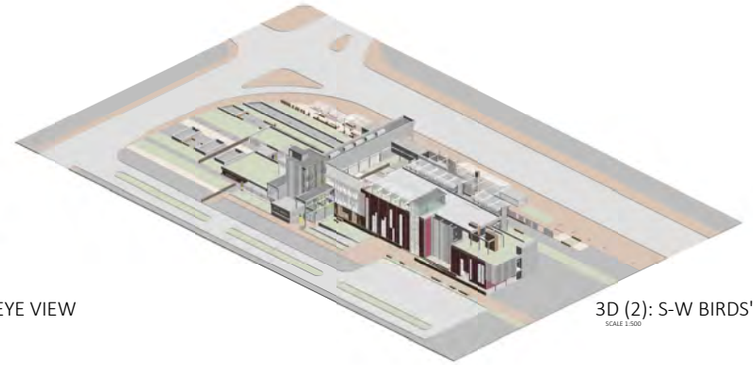
REVEALING THE INVISIBLE:

FINAL TECHNICAL DOCUMENTATION

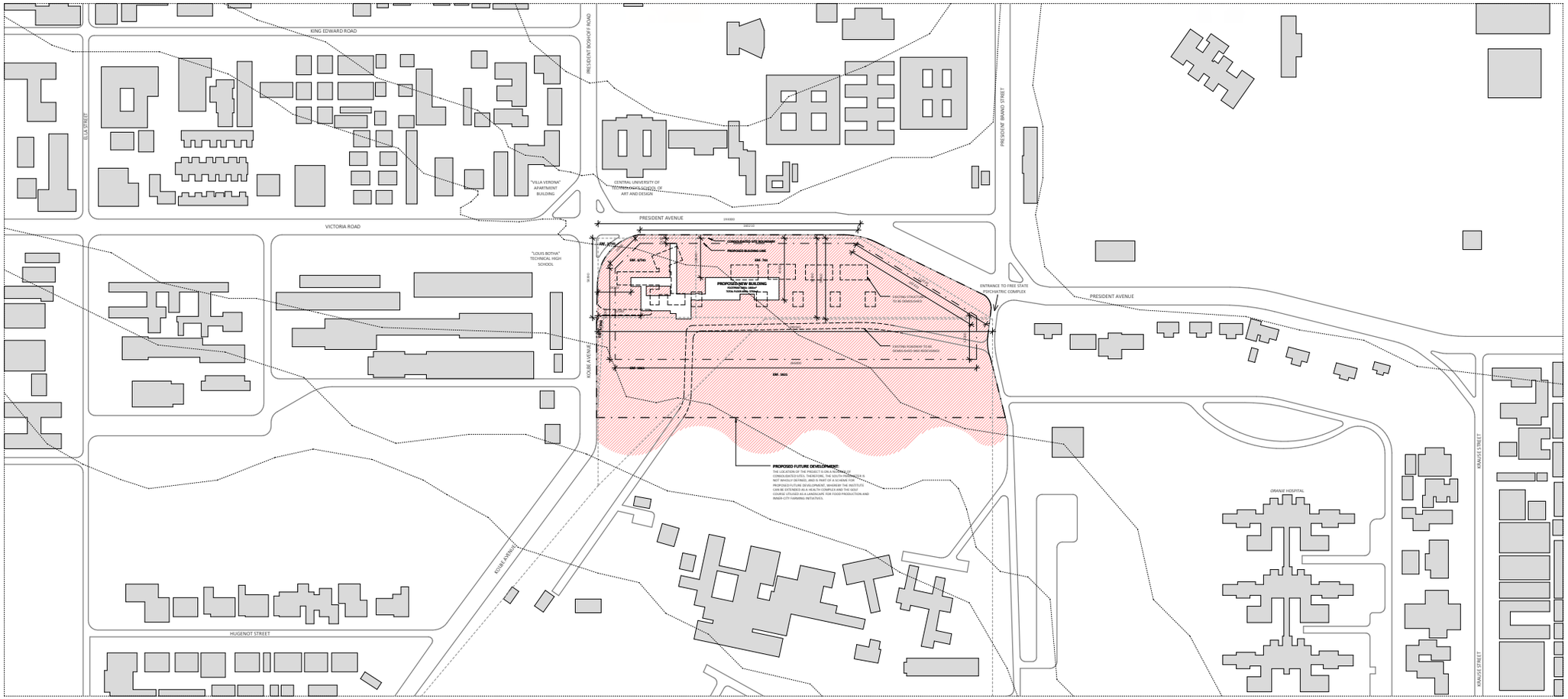
INSTITUTE FOR DISEASE AWARENESS

LOCALITY PLAN: ORANJESIG IN BLOEMFONTEIN
SCALE 1:50 000

3D (1): N-E BIRD'S EYE VIEW
SCALE 1:500



3D (2): S-W BIRDS' EYE VIEW
SCALE 1:500



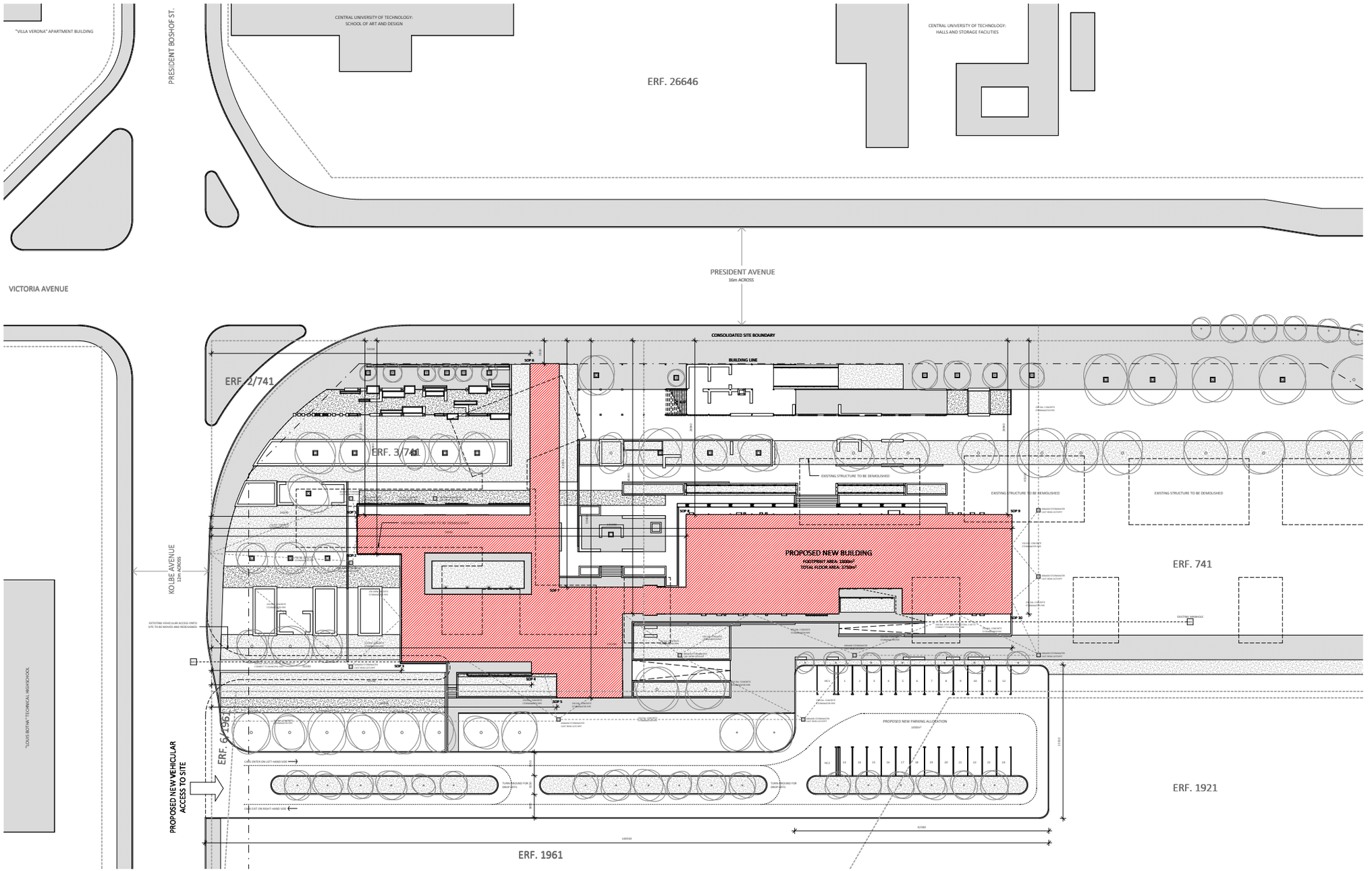
LOCALITY PLAN: SITE IN ORANJESIG
SCALE 1:1000

INSTITUTE FOR DISEASE AWARENESS (SHEET 1 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



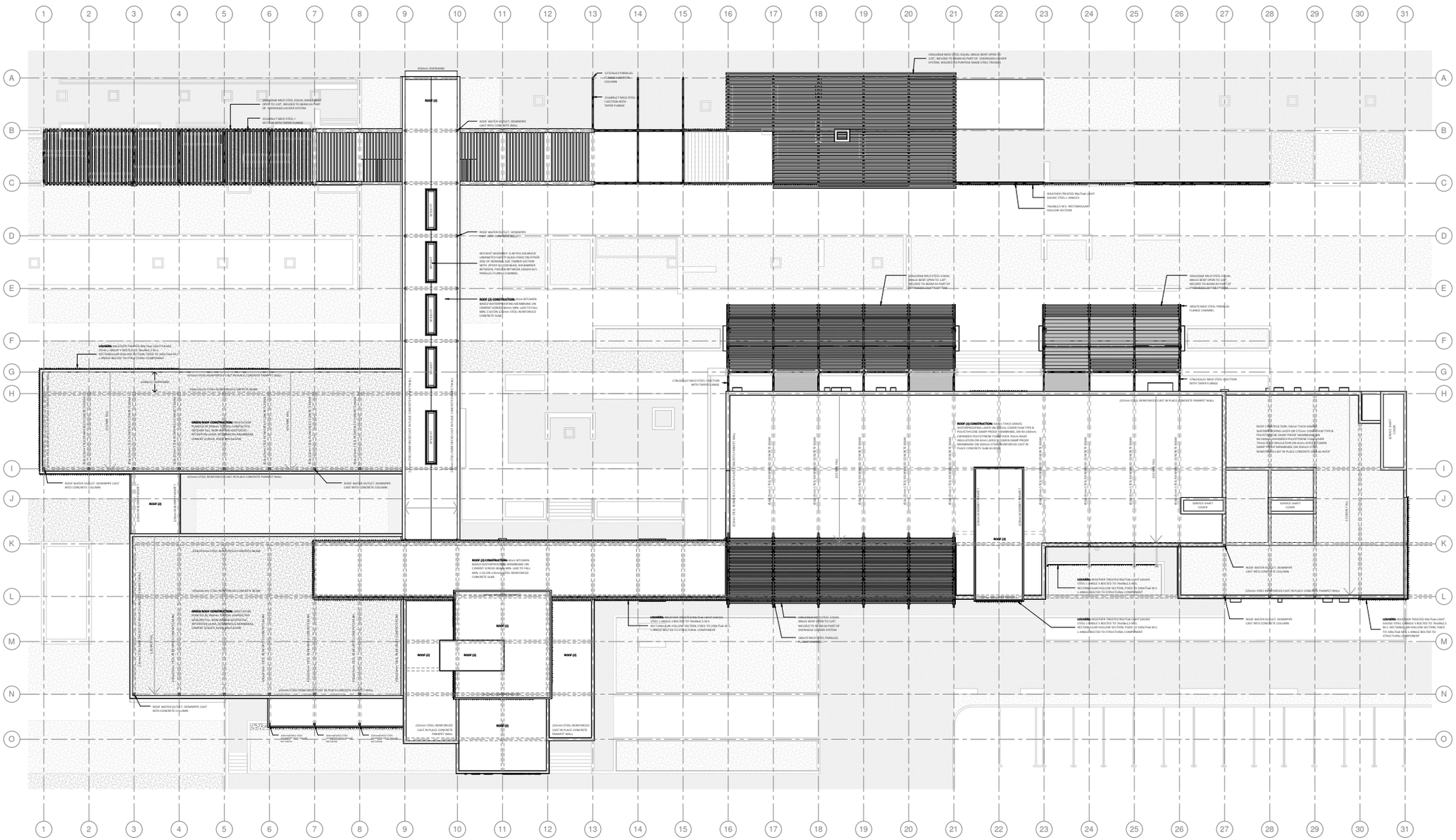
SITE PLAN
SCALE 1:200

INSTITUTE FOR DISEASE AWARENESS (SHEET 2 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



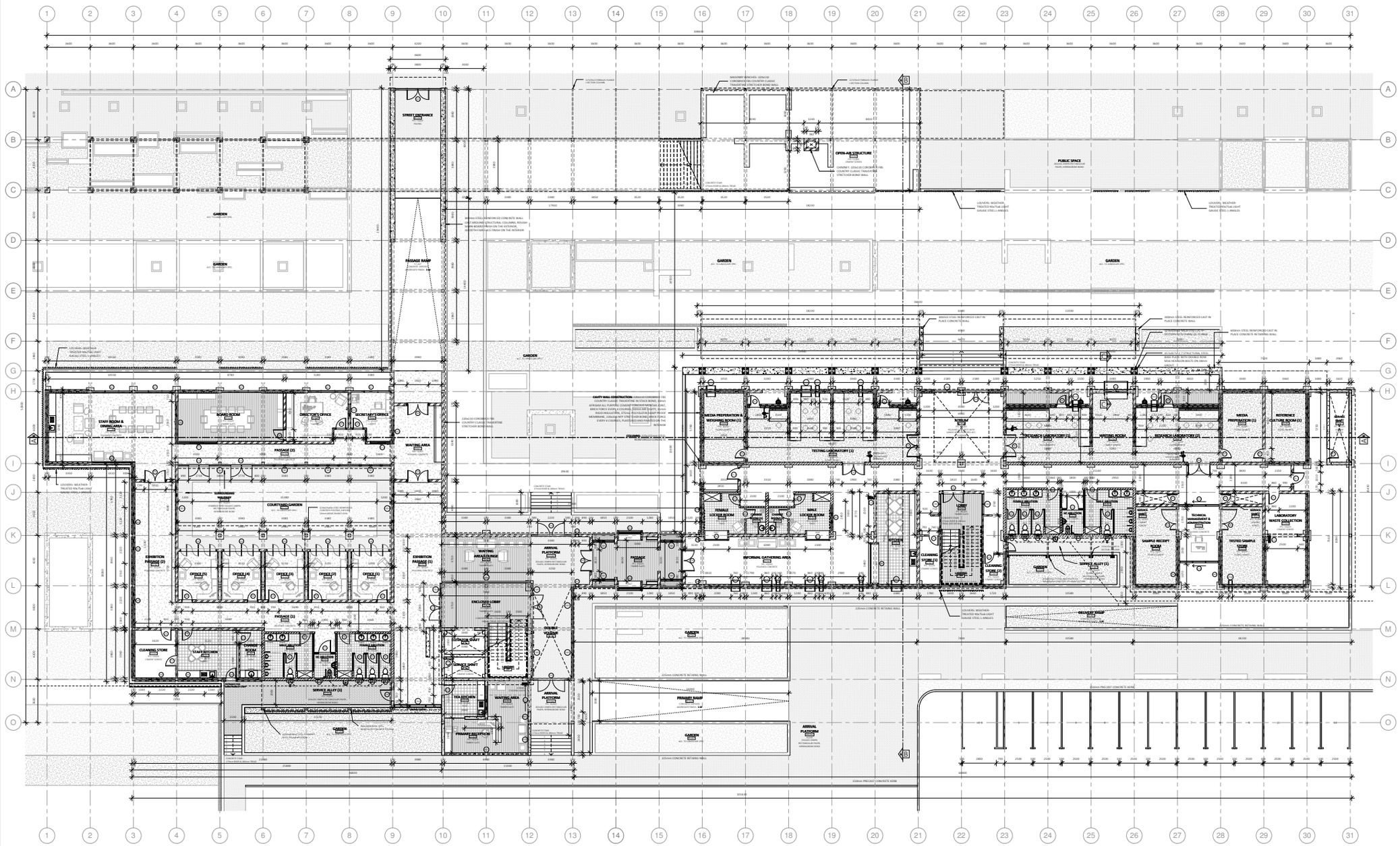
ROOF PLAN
SCALE 1:100

INSTITUTE FOR DISEASE AWARENESS (SHEET 3 OF 12)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



GROUND FLOOR PLAN
SCALE 1:100

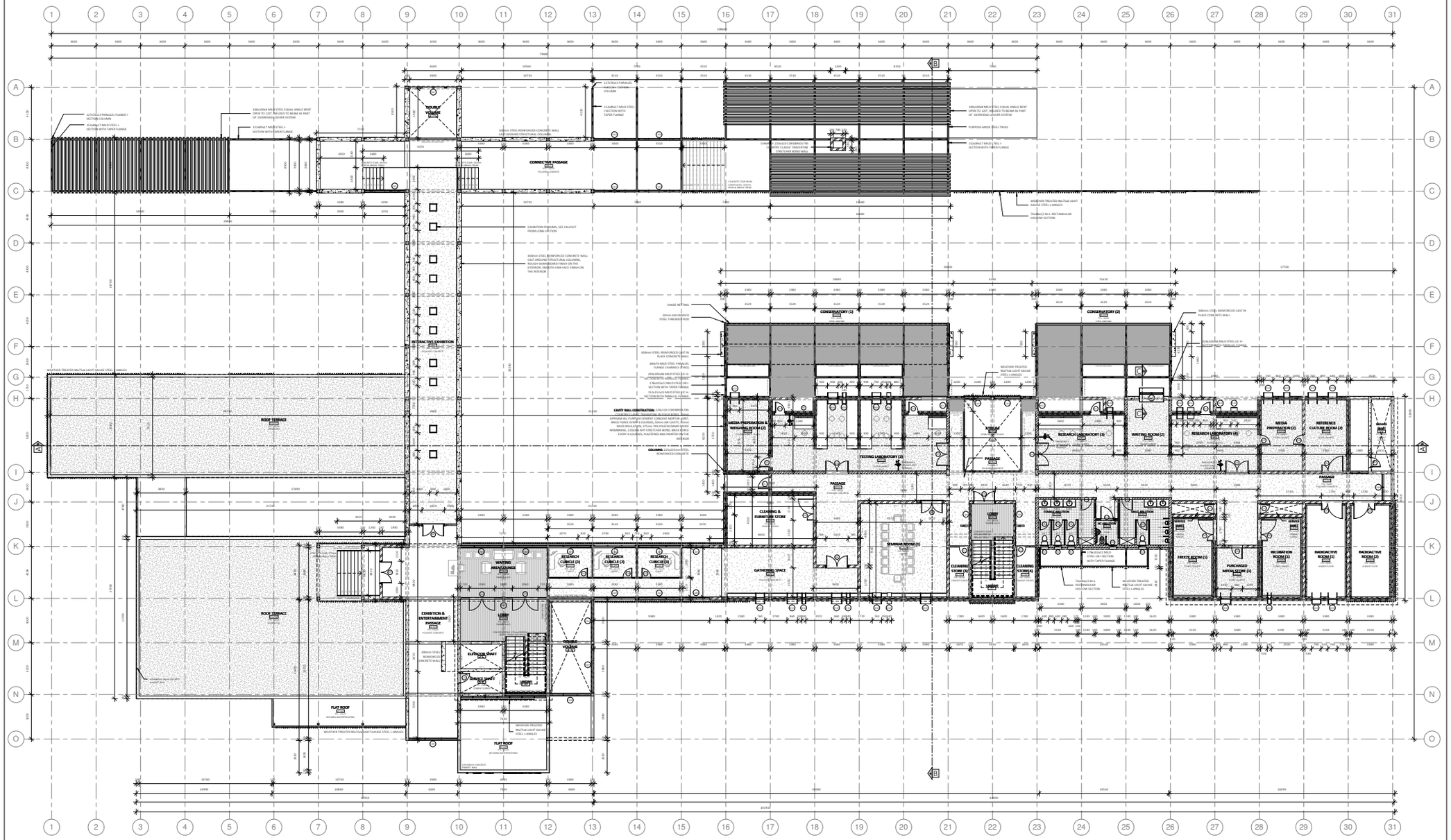
214

INSTITUTE FOR DISEASE AWARENESS (SHEET 4 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



FIRST FLOOR PLAN
SCALE 1:100

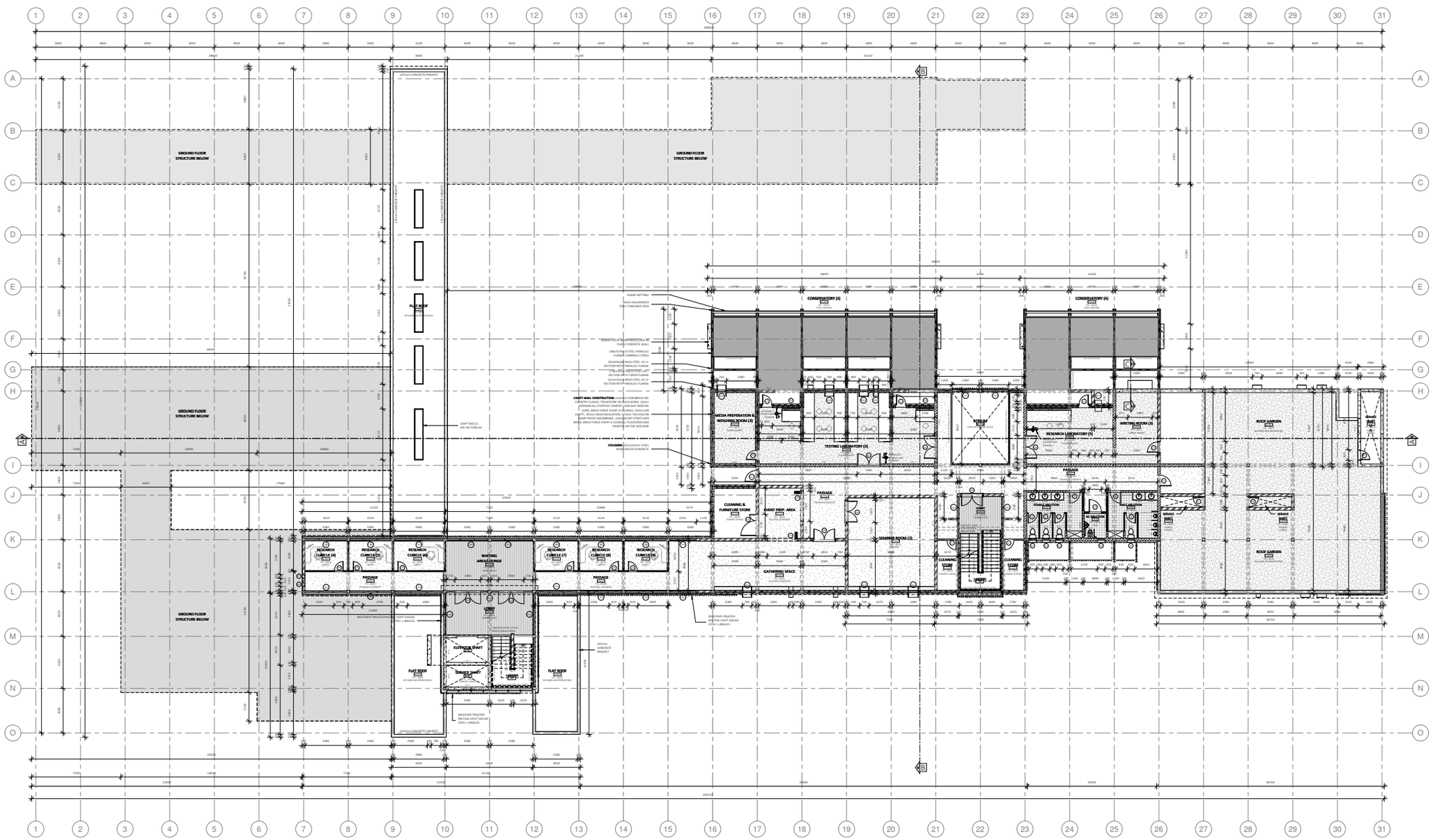
215

INSTITUTE FOR DISEASE AWARENESS (SHEET 5 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



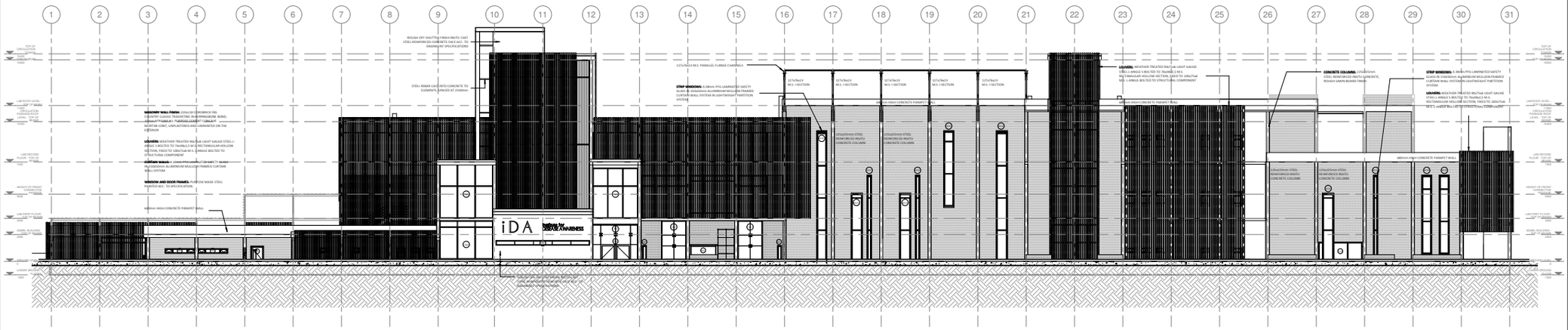
SECOND FLOOR PLAN
SCALE 1:100

INSTITUTE FOR DISEASE AWARENESS (SHEET 6 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

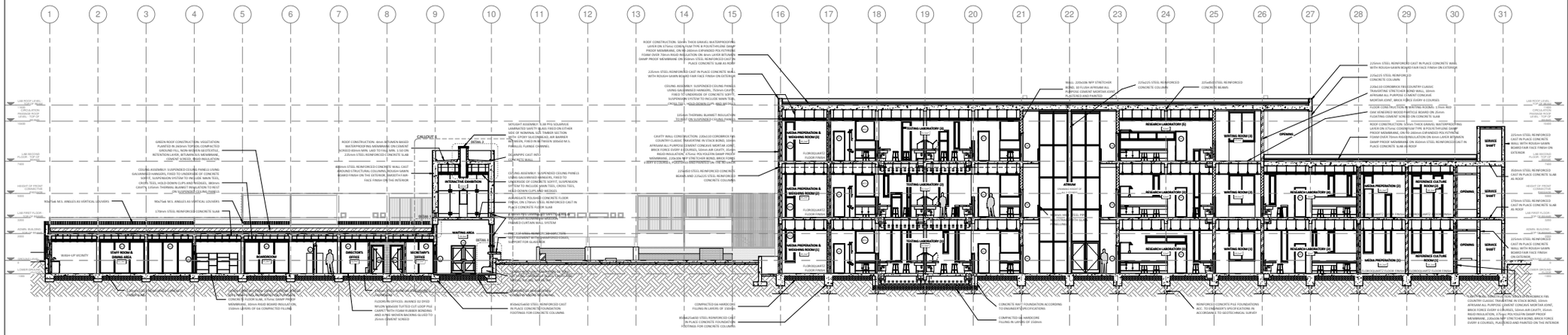
CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



SOUTH ELEVATION

SCALE 1:100



LONGITUDINAL SECTION (A:A)

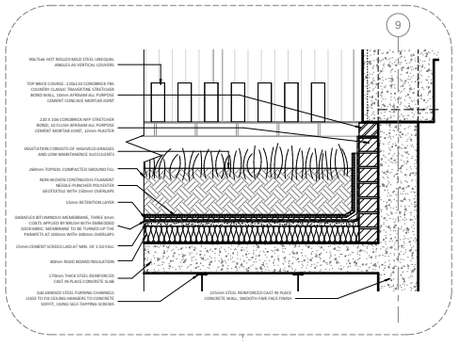
SCALE 1:100

INSTITUTE FOR DISEASE AWARENESS (SHEET 7 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

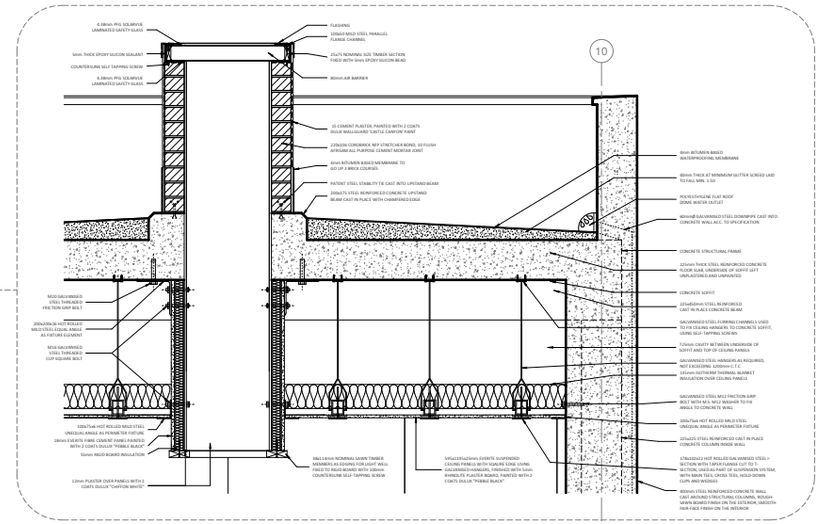
CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



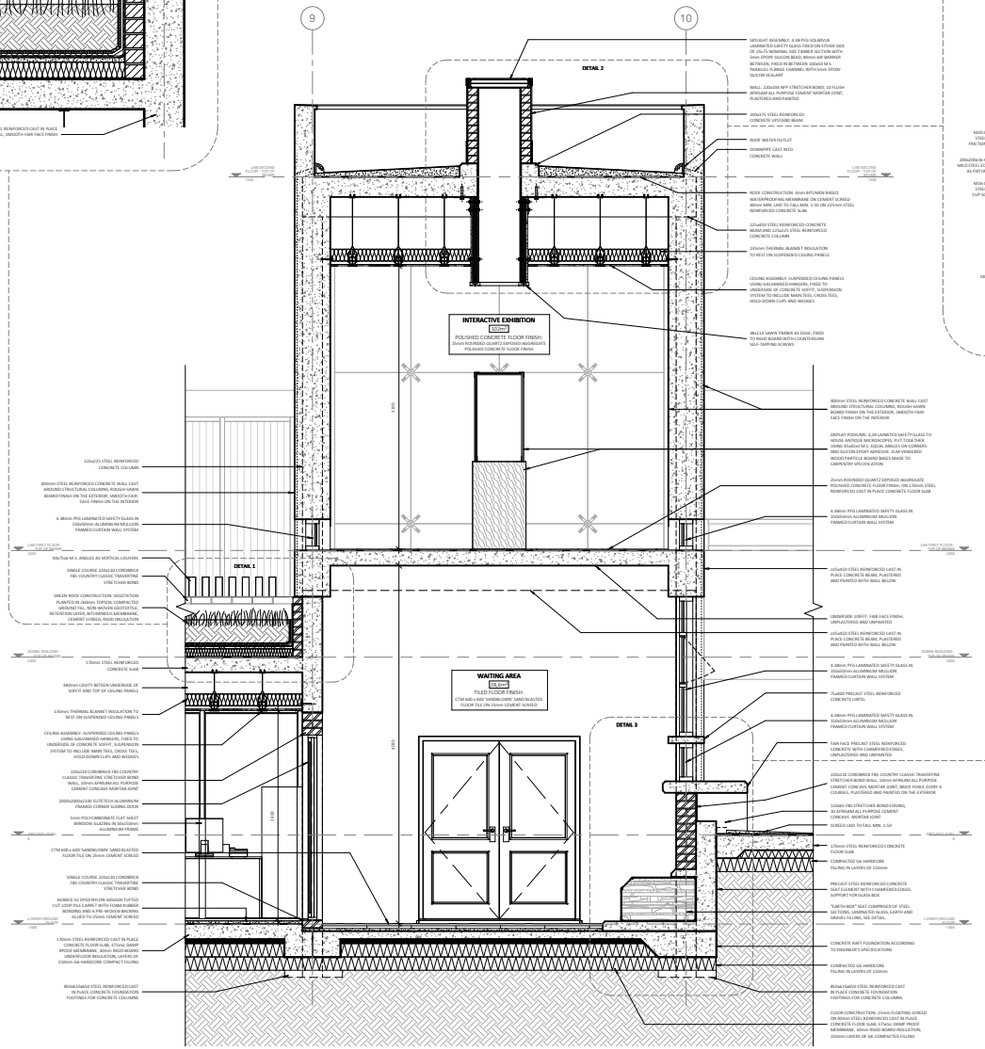
DETAIL 1: ROOF GARDEN

SCALE 1:10



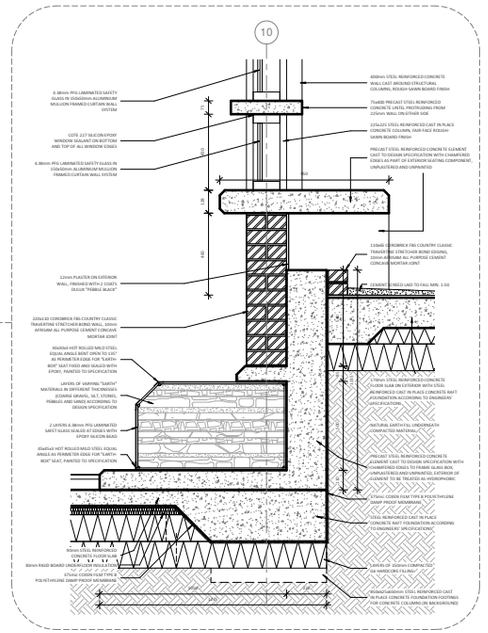
DETAIL 2: SKYLIGHT OVER INTERACTIVE EXHIBITION

SCALE 1:10



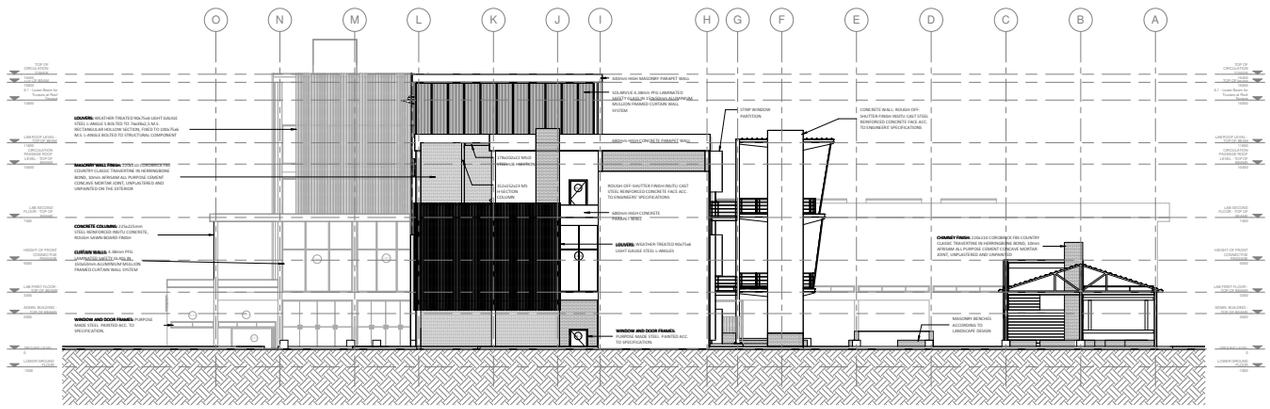
SECTION AA - CALLOUT 1: INTERACTIVE EXHIBITION PASSAGE

SCALE 1:20



DETAIL 3: "EARTH-BOX" SEAT UNDERNEATH EXHIBITION

SCALE 1:10

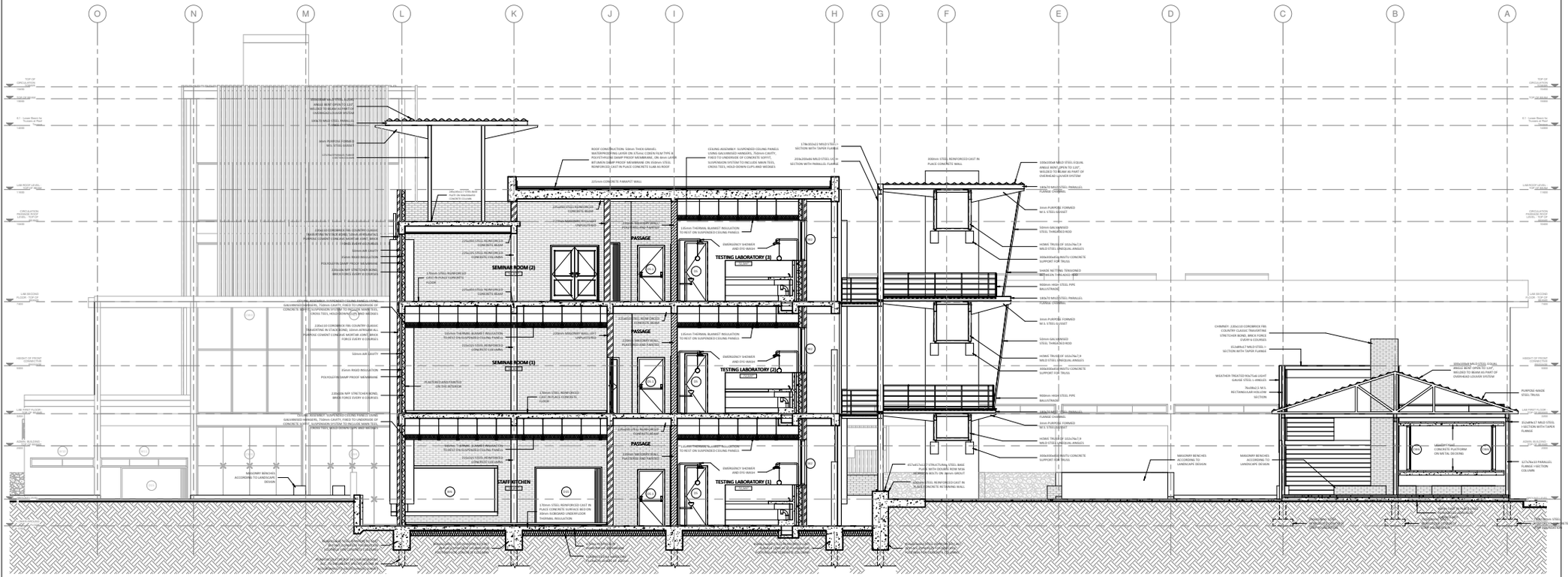


WEST ELEVATION

SCALE 1:100

3D SECTION: VIEW INTO LABORATORIES

UNSCALED



CROSS SECTION (B:B)

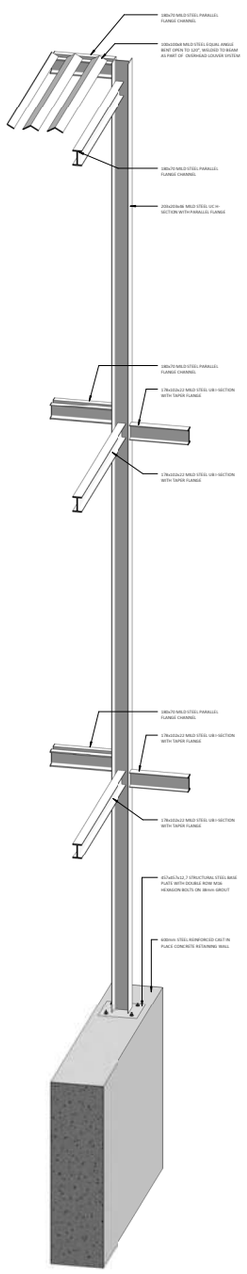
SCALE 1:50

INSTITUTE FOR DISEASE AWARENESS (SHEET 9 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

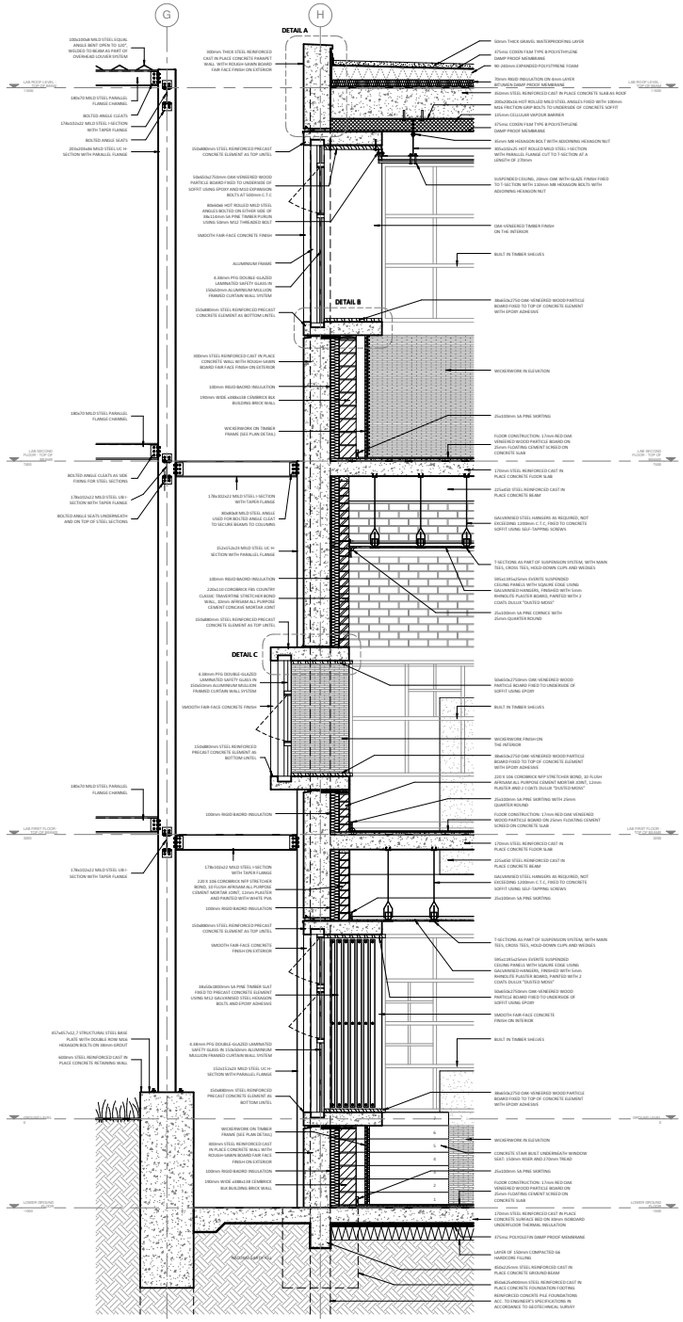
CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



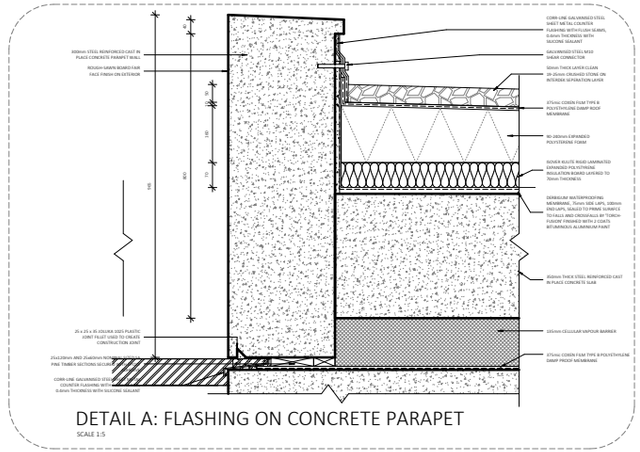
3D DETAIL SECTION: CONNECTION BETWEEN ELEVATED CONSERVATORIES AND LABORATORIES

SCALE 1:20



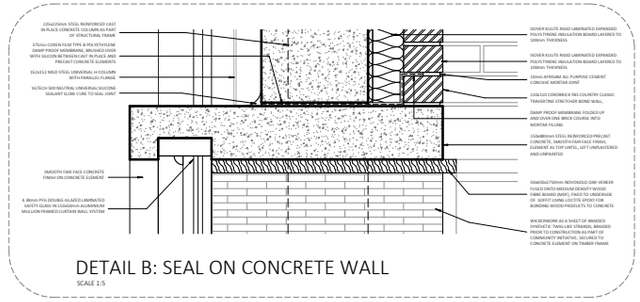
SECTION CC: PERIMETER OF WRITING ROOMS

SCALE 1:20



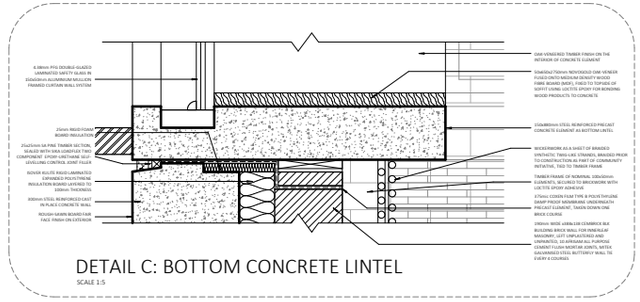
DETAIL A: FLASHING ON CONCRETE PARAPET

SCALE 1:5



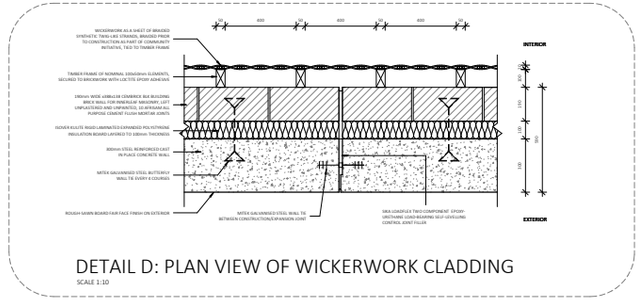
DETAIL B: SEAL ON CONCRETE WALL

SCALE 1:5



DETAIL C: BOTTOM CONCRETE LINTEL

SCALE 1:5



DETAIL D: PLAN VIEW OF WICKERWORK CLADDING

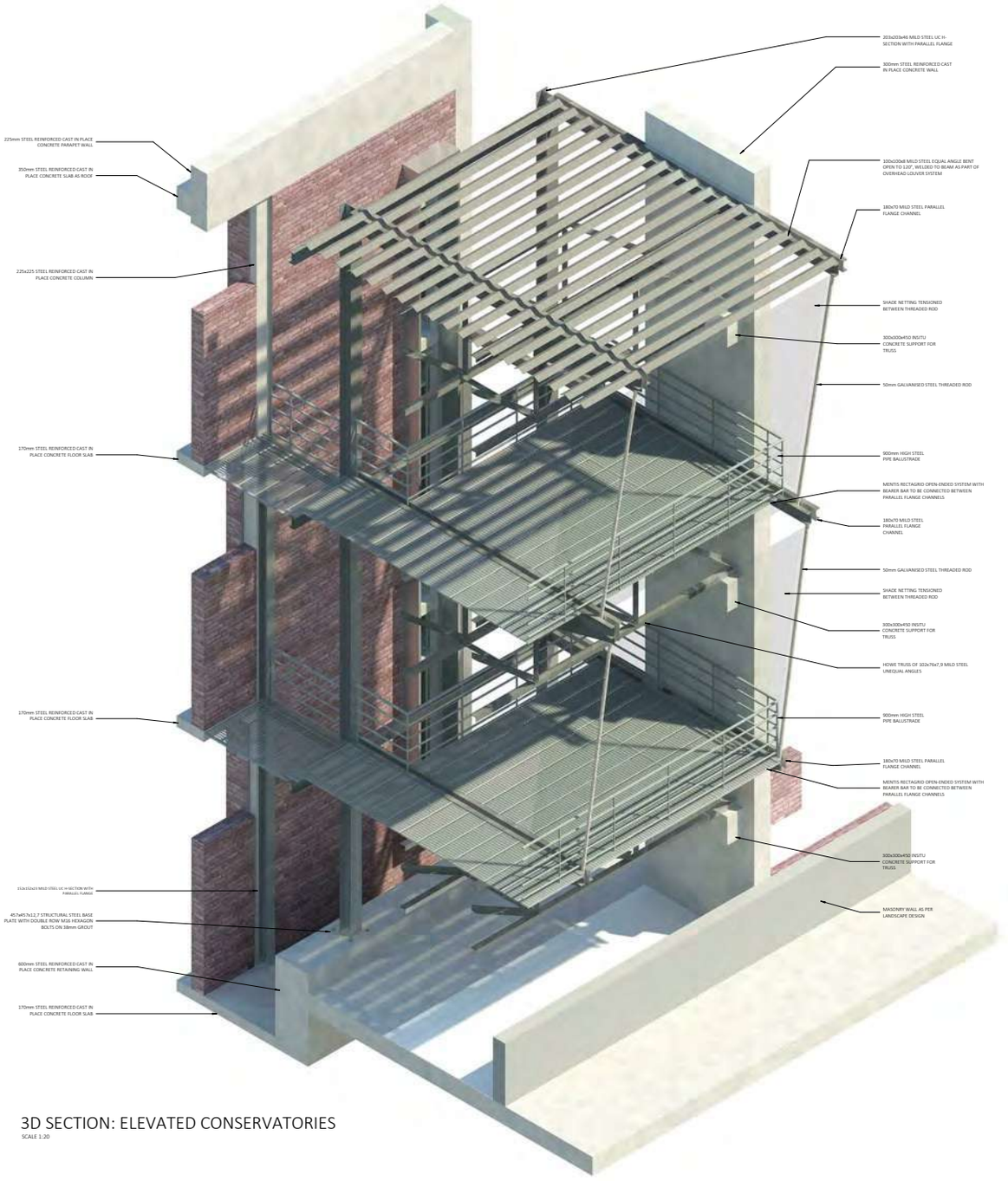
SCALE 1:10

INSTITUTE FOR DISEASE AWARENESS (SHEET 10 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJIESIG, BLOEMFONTEIN

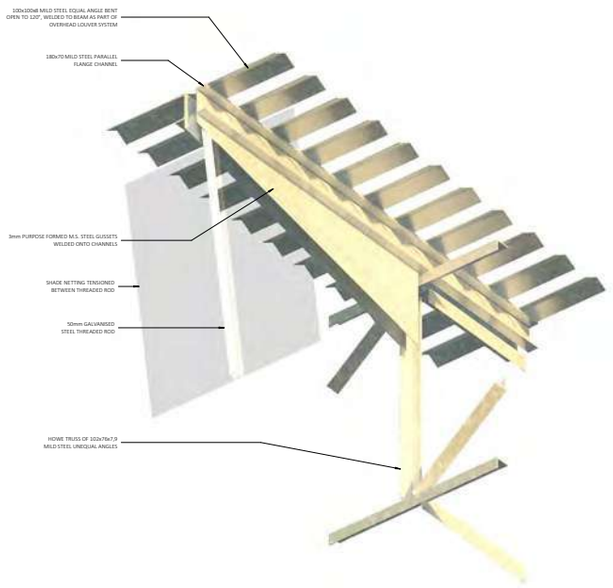
CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529



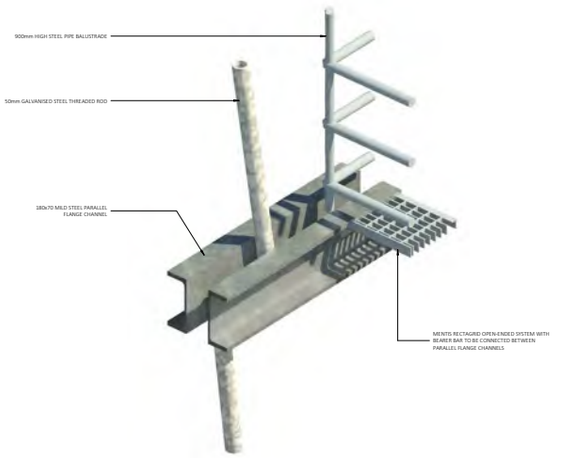
3D SECTION: ELEVATED CONSERVATORIES

SCALE 1:20



DETAIL: TOP CONNECTION

SCALE 1:10



DETAIL: BOTTOM CONNECTION

SCALE 1:5

INSTITUTE FOR DISEASE AWARENESS (SHEET 11 OF 11)

FREE STATE PSYCHIATRIC COMPLEX, ORANJESIG, BLOEMFONTEIN

CLIENT: NATIONAL INSTITUTE FOR COMMUNICABLE DISEASE (NICD)

LAURA-ANNE FOX | 2010017529