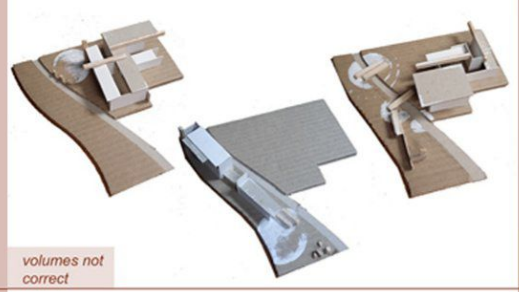
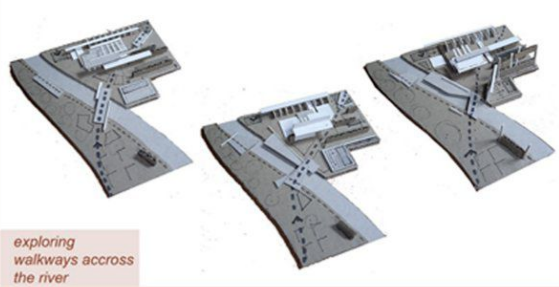
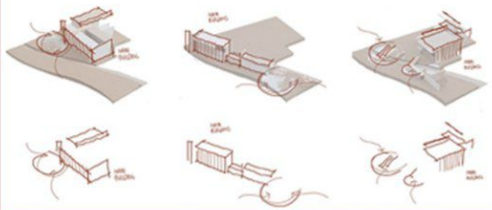
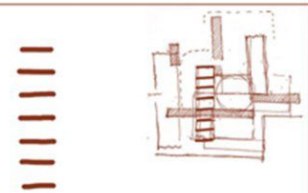
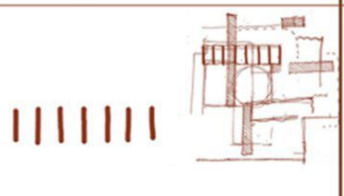
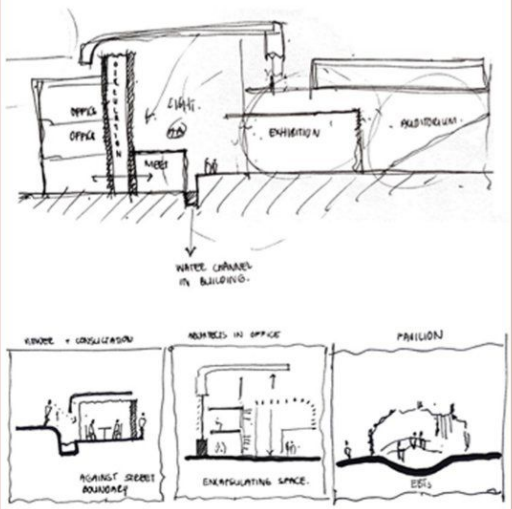
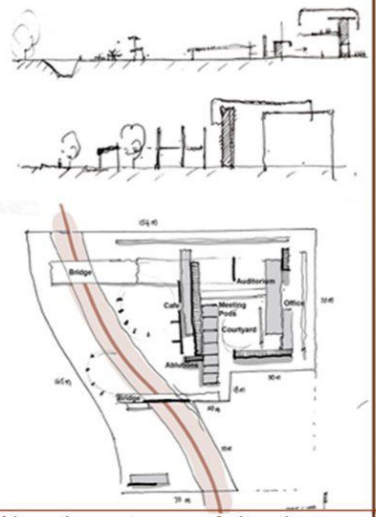
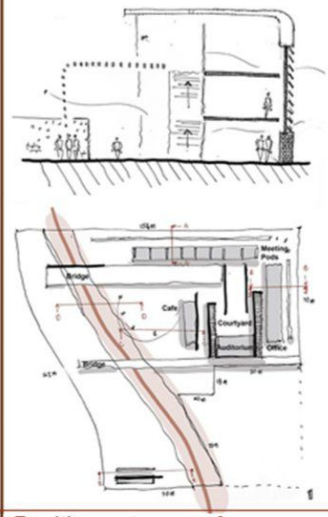
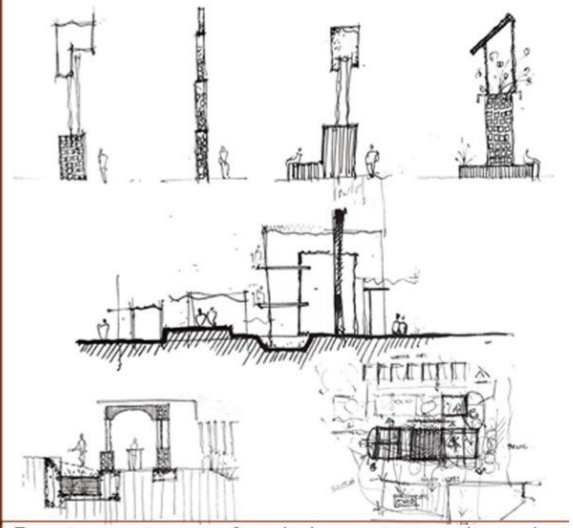
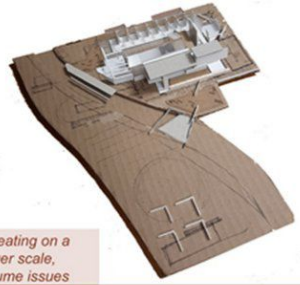
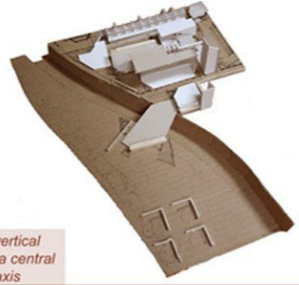
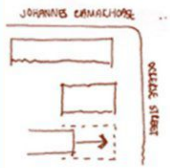
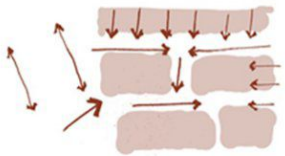
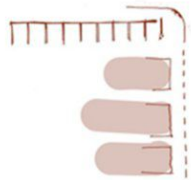
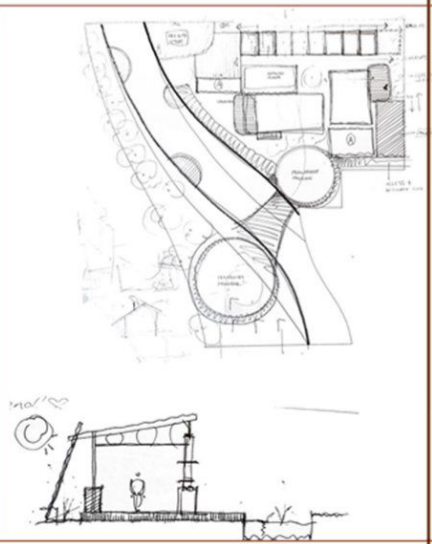
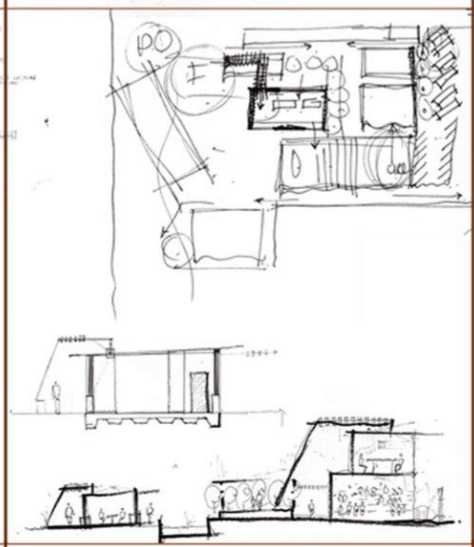
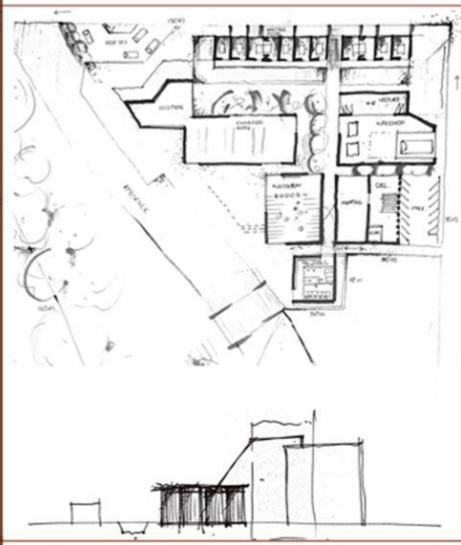
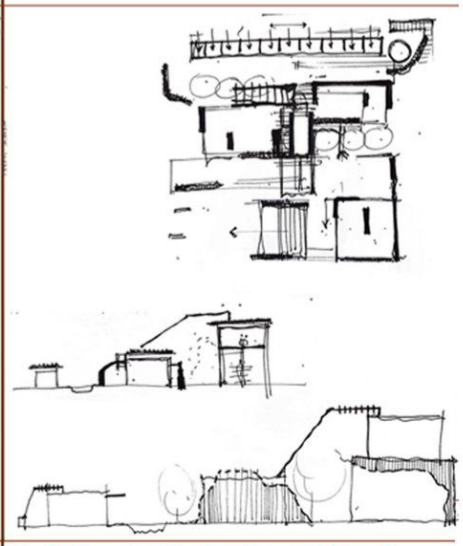
MODEL	 *volumes not correct*	 *meeting spaces in East to West orientation*	 *meeting spaces in South to North orientation*	 *exploring walkways accross the river*
SCALE	1: 1000 1: 1000 1: 1000	1: 1000	1: 1000	1: 1000 1: 1000 1: 1000
KEY ELEMENTS	Massing on the **Eastern side** of the Apiesrivier Massing on the **Western side** of the Apiesrivier Massing as a **hybrid** on site 	**Meeting spaces** identified and placed within the cluster of buildings in **vertical orientation**. 	**Meeting spaces** rotated and placed on edge of the cluster of buildings in a **horizontal orientation**. 	Explore **walkways** throughout the site Explore **walkways** and **different forms** Explore **walkways** and built fabric as **a landmark** 
PARTI				
SKETCHES				
OUTCOME	Positive outcome for testing massing on site. Sketches gave way to manipulation of NGL during later design stages.	Negative outcome of situating buildings away from the boundary, orientation was problematic.	Positive outcome of re-orientating the meeting pods buildings.	Posotove outcome of exploring routes on site and walkway accross the river. Landmark concepts gave way to gabion stuctures in the design.

ITERATIVE DESIGN

MODEL	 *repeating on a larger scale, volume issues*	 *moving vertical fabric to a central point of axis*	 *removing parking from Eastern boundary*	 *creating space in river to create public space*
SCALE	**1: 500**	**1: 500**	**1: 500**	**1: 500**
KEY ELEMENTS	Repeating the exploration on a **larger scale** and deciding where the bulk of the **massing** should be placed  Considering where **circulation space** should be for **vehicles** 	Creating elements where **vertical built fabric** is placed throughout the site between the buildings 	Placing **all buildings on boundaries** again as per form generators  Creating a **core** within the site as a focus point for **programme and technology** 	Expanding the **space from the river** to filter through the buildings. 
PARTI				
SKETCHES				
OUTCOME	Positive outcome for moving to a larger scale, but negative for the overall placement of buidings.	Negative outcome for the placement of parking on the ground level - not adhering to form generators.	Positive outcome for the development of the floor plan and finer spatial details that came into place.	Positive outcome for the creation of public seating on the river bank and addition of plants and retaining walls.

ITERATIVE DESIGN

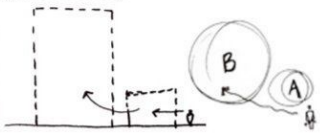
SPATIAL

Figure 17: Middle West Spirits (Abdel, 2023)

Middle West Spirits

Jonathan Barnes Architecture and Design,
2016, Colombus, US
10 000m2
Restaurant, Brewery

(Abdel 2023)



Points of interest:
Hierarchy, human- to industrial scale and natural lighting

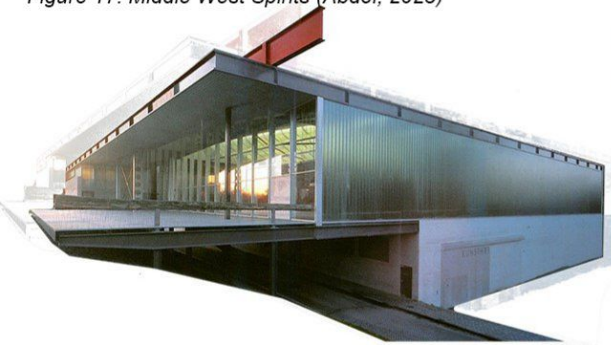
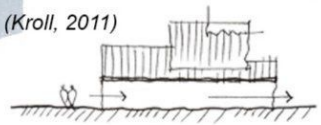


Figure 18: The Kunsthal (Kroll, 2011)

Kunsthal

OMA Architects
1992, Rotterdam, Netherlands
3 300 m2
Museum

(Kroll, 2011)



Points of interest:
Public walkway and subdivided volumes

Figure 19: 44 On Stanley (Bahmann, Frenkel, 2012)

44 On Stanley

Kate Otten Architects
2003, Johannesburg, South Africa
11 000 m2
Mixed Use Urban Development
(Bahmann, Frenkel, 2012)

Points of interest:
Urban renewal, passageway movement, selected gates

CONSTRUCTION

EBT - STRUCTURE

Figure 20: Silindokuhle Creche (Chapman, 2019)

Silindokuhle Creche

Kevin Kimwelle
2017, Eastern Cape, SA
50 m2
Educational
(Chapman, 2019)

Low Tech & Underdeveloped
Composite wall with glass wine bottles and timber panels as infill

EBT - CONSTRUCTION PROCESS

Figure 21: Soil and Serenity (Veld Architects, 2023)

Soil and Serenity

Veld Architects
2022, Centurion, SA
500 m2
Residence
(Veld Architects, 2023)

Low Tech & Developed
Rammed earth walls made on site by using the soil from the excavations, with plywood formwork and a pneumatic press.

EBT - CONSTRUCTION PROCESS

Figure 22: UJ 3DCP House (News 24, 2023)

UJ 3DCP House

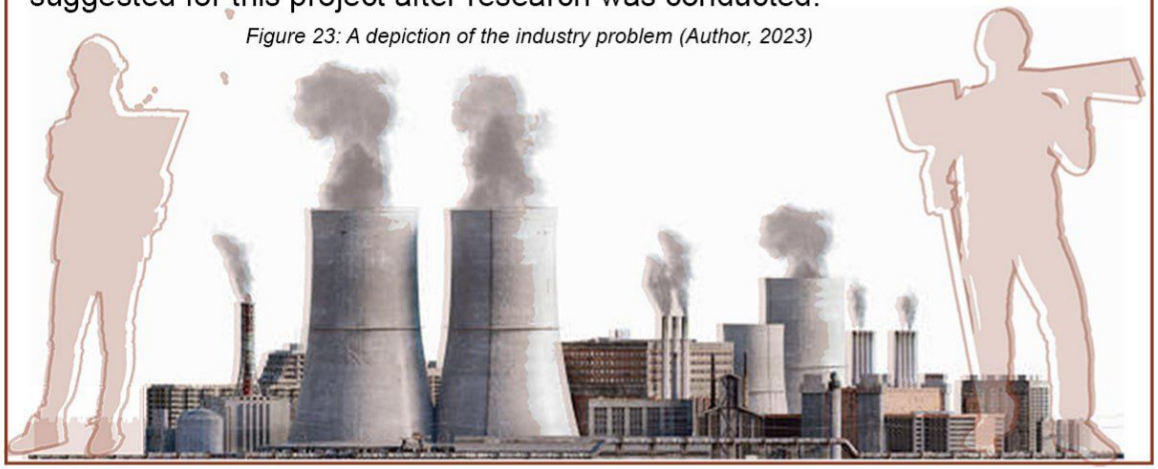
University of Johannesburg & Afrisam
2022, Johannesburg, South Africa
RDP Housing Scheme Test
(News 24, 2023)

High Tech & Underdeveloped
Additive manufacturing is used to create layers of concrete on top of each other with a carterian robot without the use of formwork

INDUSTRY PROBLEM

Based on the research conducted by the "Extend Ways of Working" DIT group, it has become apparent that current conventional building technologies have an immense negative impact on the natural environment. The plateau reached within the industry's innovation with regards to construction, raises the need to incorporate more other solutions of building technologies - EBTs are suggested for this project after research was conducted.

Figure 23: A depiction of the industry problem (Author, 2023)



RESEARCH

The dissertation "A critical analysis of the potential impact of higher education on South African emerging building technologies" focused on solutions for the probelms caused by conventional technologies in the industry, creating a definition and compiling a catalogue from there on.

Figure 24: The front page of the dissertation mentioned above (DIT Research Group, 2023)

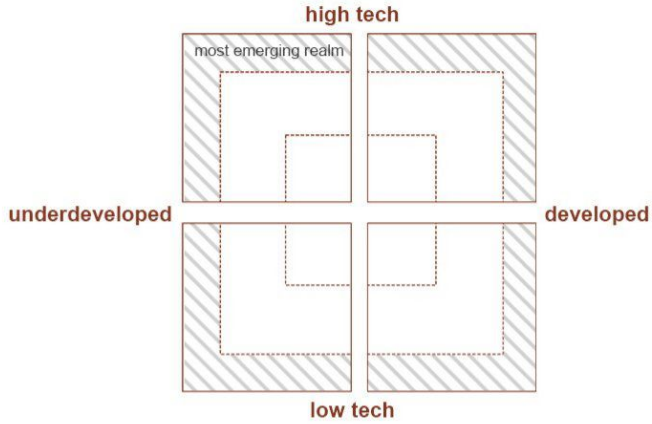


Figure 25: The diagram used to plot EBT projects in the dissertation (DIT Research Group, 2023)

EBTs DEFINITION

A definition for EBTs were derived from the research done throughout the year, which was used to classify projects done in SA in a catalogue, which led to precedent studies that would inform the building technologies used in the project.

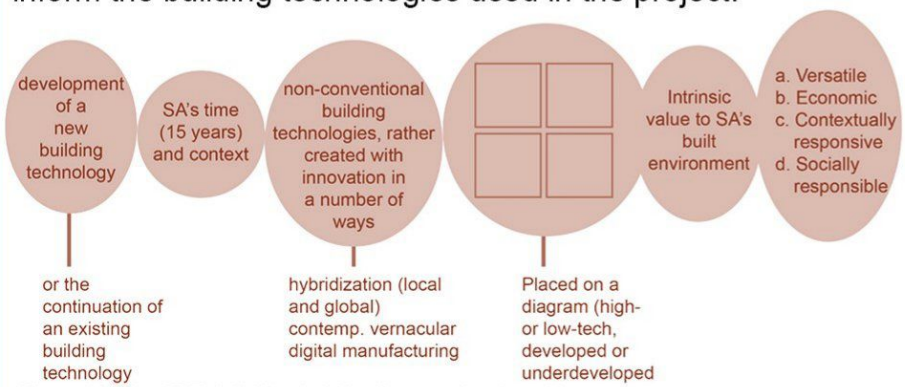


Figure 26: The EBT definition bubble diagram developed in the dissertation (DIT Research Group, 2023)

ARCHITECT & PROJECT	IMAGE	YEAR	LOCATION	REPORT	EMERGING BUILDING TECHNOLOGY			PRODUCTION MODE		DEVELOPMENT		VALUE
					BUILDING MATERIAL	CONSTRUCTION PROCESS	STRUCTURAL SYSTEM	LOW-TECH (traditional or hand-based)	HIGH-TECH (industrialised)	UNDER-DEV.	DEV.	

Figure 27: The catalogue headings used for each project that was included in the research (DIT Research Group, 2023)

*An **emerging building technology (EBT)** is the **development or continuation** of a **building technology** that has **emerged over the past 15 years** within the **South African built environment.** Emerging building technologies are **counter to the current/conventional building technologies** that are mainly used in the industry and can be formulated in a variety of ways. It can be due to the hybridization of local and global technologies (Louw, 2022: 2) or the contemporary consideration of vernacular traditions/African building dynamics (Steyn, 2020: 2). Another way is by means of digital manufacturing with involvement of "craft practice as a knowledge-generating activity…" (Loh, 2019: 258), or the invention of a complete new material, construction process or structural system (Wu, Wei & Peng, 2019: 1). These building technologies can be placed on a spectrum of being **low-tech** (hand-based) or **high-tech** (industrialised) as a mode of production as well as receiving a **development status** within the local context. Emerging building technologies hold intrinsic value to the built environment by being either **versatile, economic, socially responsible or contextually responsive.***

The full definition of emerging building technologies (DIT Group 2023)

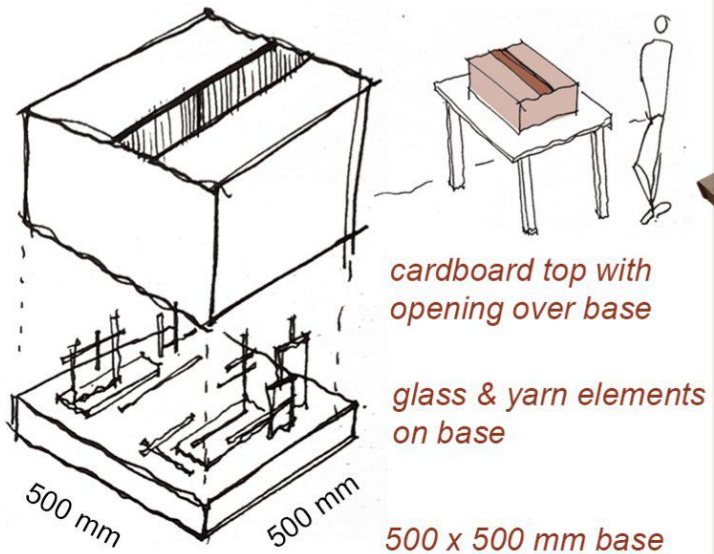
DESCRIPTION

Driven by curiosity of **how EBTs are perceived in the built industry,** with special focus on the architect as the driver of design and the end users that utilise it, the mini project aimed to explore the layers of building technology intricacy in the architectural discipline. Hierarchy and craft stood at the forefront as the main topics of the exploration, with the end goal of placing elements in layers of visual emergence as the user interacts with the object.

Glass and cardboard elements were fixed to the base and connected with yarn, which symbolised the mix between conventional- and emerging building technologies in the industry. A cover was placed on top as to encourage individuals to interact with the installations on their own and formulate opinions based on their unique experience.

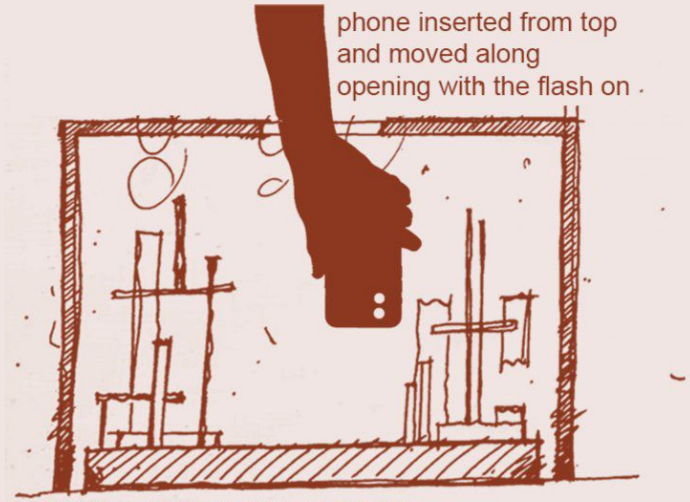
TOP-COVERED INSTALLATION

Figure 27: All sketches and photos done by Author for the Mini Project (Author, 2023)



PRODUCT

Insert your phone, record what was inside the box and document what you saw either in text or sketches - a space with pen and paper was made available at the end of the installation.



SECTION THROUGH INSTALLATION
(illustrating the use)

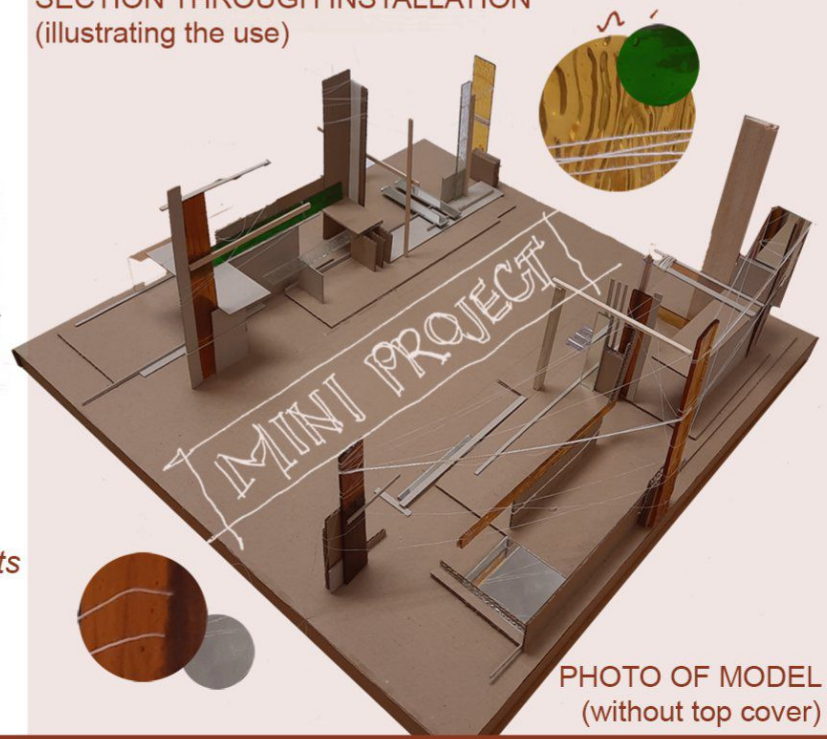


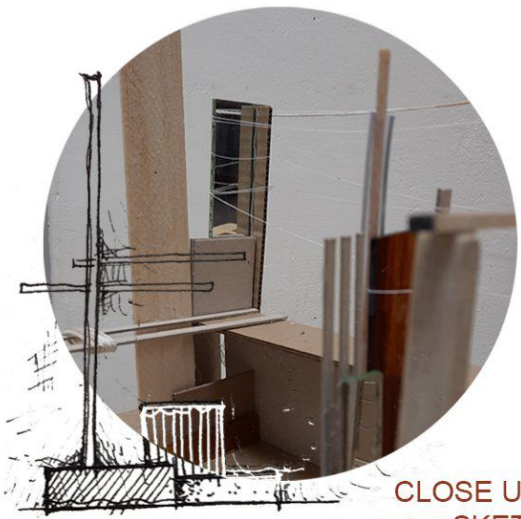
PHOTO OF MODEL
(without top cover)

REFLECTION

The idea behind this initiative was to present emerging building technologies (EBTs) in an abstract manner as an intricate arrangement of various elements and to receive feedback from a person's experience.
Each person's feedback was reviewed and used in the formulation of my exploration models of the major project, which, after the relevant contextual research of the project's site, gave way to key spatial elements.

CONCLUSION

This mini project's outcome proved to be useful to the design process due to the feedback and interaction from other individuals. This initiative was an abstract platform that launched the major project's key elements into movement and towards a final product. The installation invoked curiosity from people that approached it and left them at a place where they had to apply their own creativity. This yielded an ideal outcome for this project that led to more concrete ideas in the major project.



CLOSE UP AND
SKETCHES

IMPACT OF MINI PROJECT

The technology of the project was approached through a lense of emerging building technology. After conducting research on which EBTs the industry is currently involved with, 3D Concrete Printing was selected as the main technology focus of the project. This was done to promote the inclusion of a currently underdeveloped and high-tech EBT in an environment that would be directly exposed to the spatial designers in the build industry.

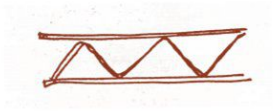
Concepts were the initial core of the technology development. Parti diagrams evolved into more complex sketches where the building technology became entangled with other structural systems.

The planning stage becomes more intricate in selecting exactly where the technology focus in the structure would be beyond the EBT. The 3DCP wall and roof connection of the auditorium was selected as the focus point. This would entail the connection between concrete and steel.

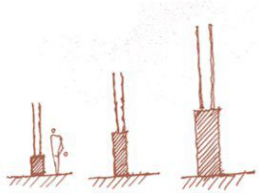
The lack of formwork in the construction process sets this technology apart from normal concrete construction. Less reinforcement is used in the walls as well, resulting in a less intensive use of additional resources to create the 3DCP walls.

Although the technology is not widely used in South Africa at the moment, this project becomes an opportunity to introduce the technology in an appropriate setting.

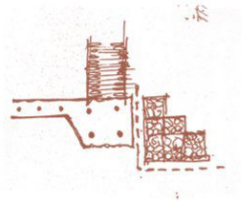
CONCEPTS



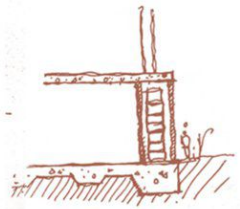
3D Printed Concrete wall parti diagram in plan



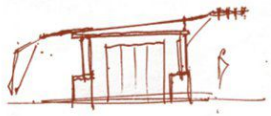
3D Printed Concrete wall in section - levels of hierarchy



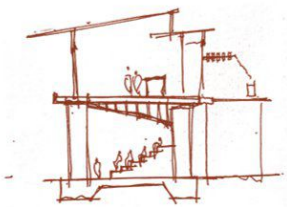
3D Printed Concrete wall detail section with adjacent gabion wal



Explorations of 3DCP wall with infill and foundation structure



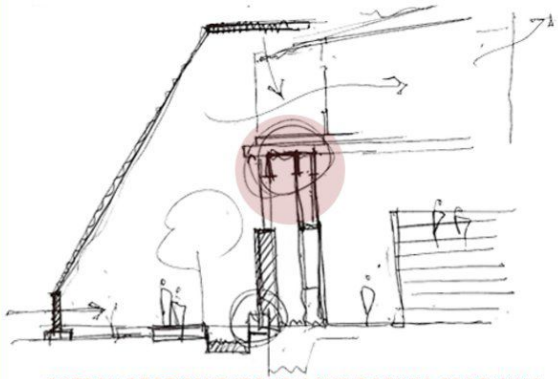
3DCP applied to smaller structures with overhangs and pergolas



3DCP applied to larger structures - auditorium space used for main detail

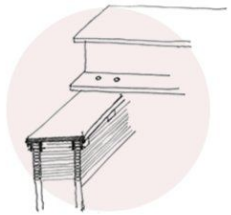
Figure 28: Technical concept sketches (Author, 2023)

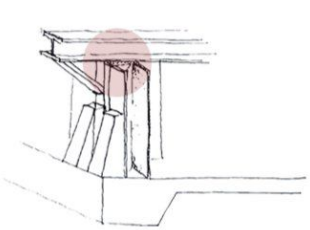
PLANNING

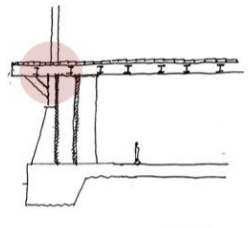


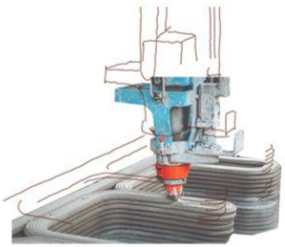
The focus for creating a detail was placed on the connection between the 3DCP wall and the steel roof structure. Following the sketches done during the planning stage, exploded isometric drawing were created in Revit and further developed later in the design. Two iterations were developed, the latter reflecting the internal wall structure.

SKETCH SECTION THROUGH AUDITORIUM 3DCP WALL

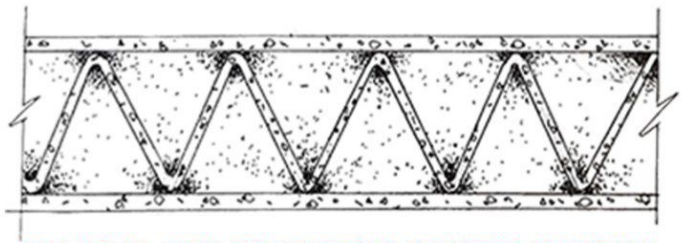






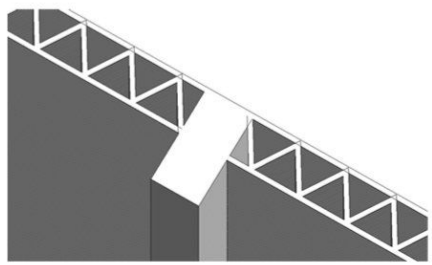


3DCP ROBOTIC ARM



WALL IN PLAN - INITIAL IDEA OF INTERNAL STRUCTURE OF 3DCP WALL

Figure 29: 3D Concrete printing proces (News 24, 2023)



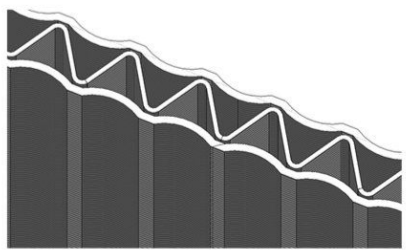
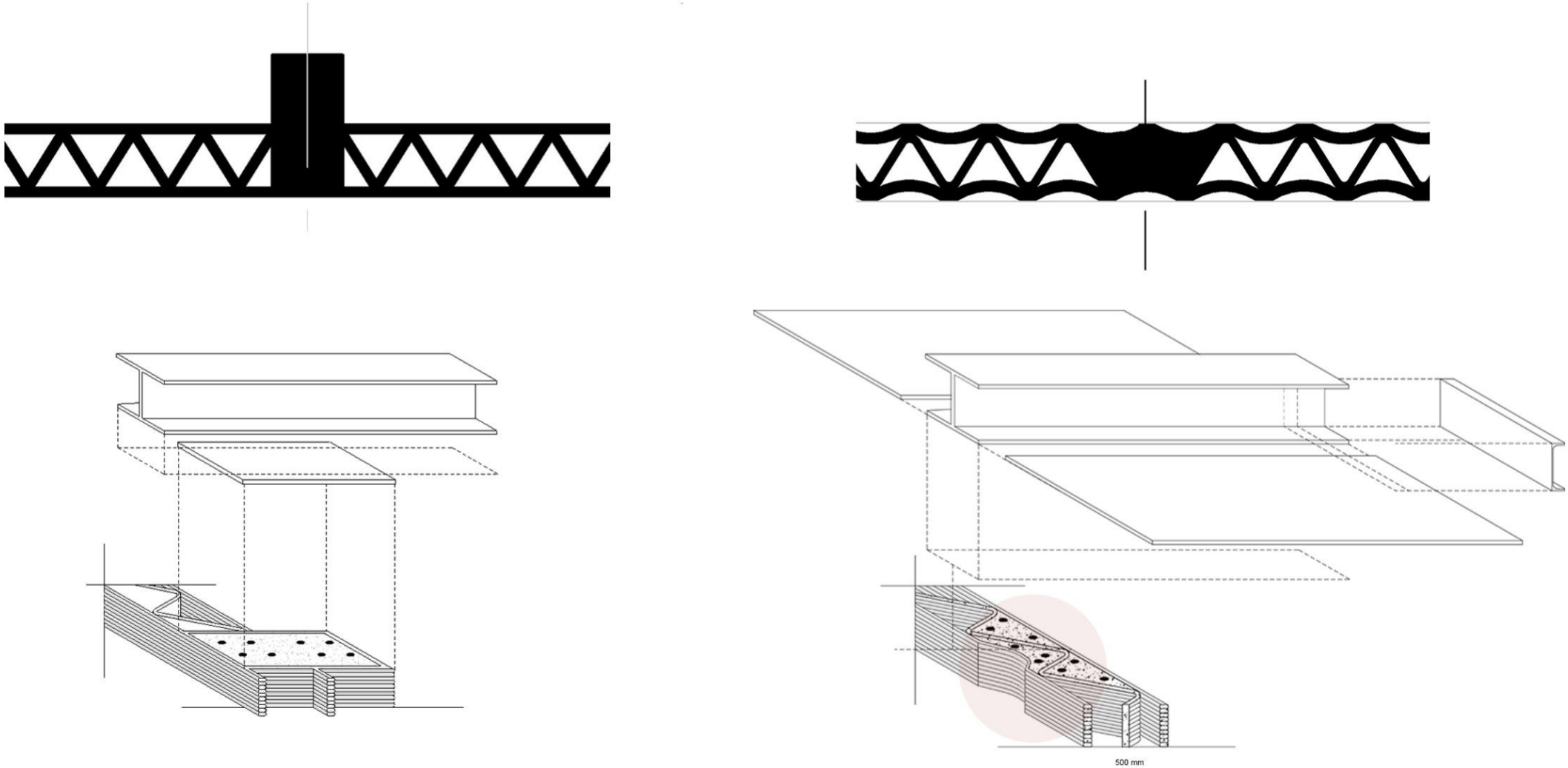


Figure 30: 3D Concrete Printing explorations done in SketchUp (Author, 2023)

DETAILS

An engineer was consulted in studio regarding this technology and process of working towards suitable details (Figure 31). Initially, the inner concrete rib in the #DCP wall did not inform the envelope or the placement of the concrete column that is meant to carry point loads from the upper steel roof beams (356 x 171 x 45 Steel I-Beams). After considering how the internal construction should be reflected, the envelope of the wall became curved to mirror what is happening with the supportive ribs inside the wall. Structural columns are concealed within this form to create a smooth, continuous envelope.



3DCP ASSEMBLY DETAIL FIRST DRAUGHT
SCALE 1: 10

3DCP ASSEMBLY DETAIL SECOND DRAUGHT
SCALE 1: 10

Figure 31: Two Revit drawing showing the planning stages of the 3DCP wall and roof connection of the auditorium (Author, 2023)

Integral and Sustainable Design: Transformative Perspectives

The integral theory suggests that the four quadrants used to analyse a design would include the inside and outside perspectives of the collective- and individual user.

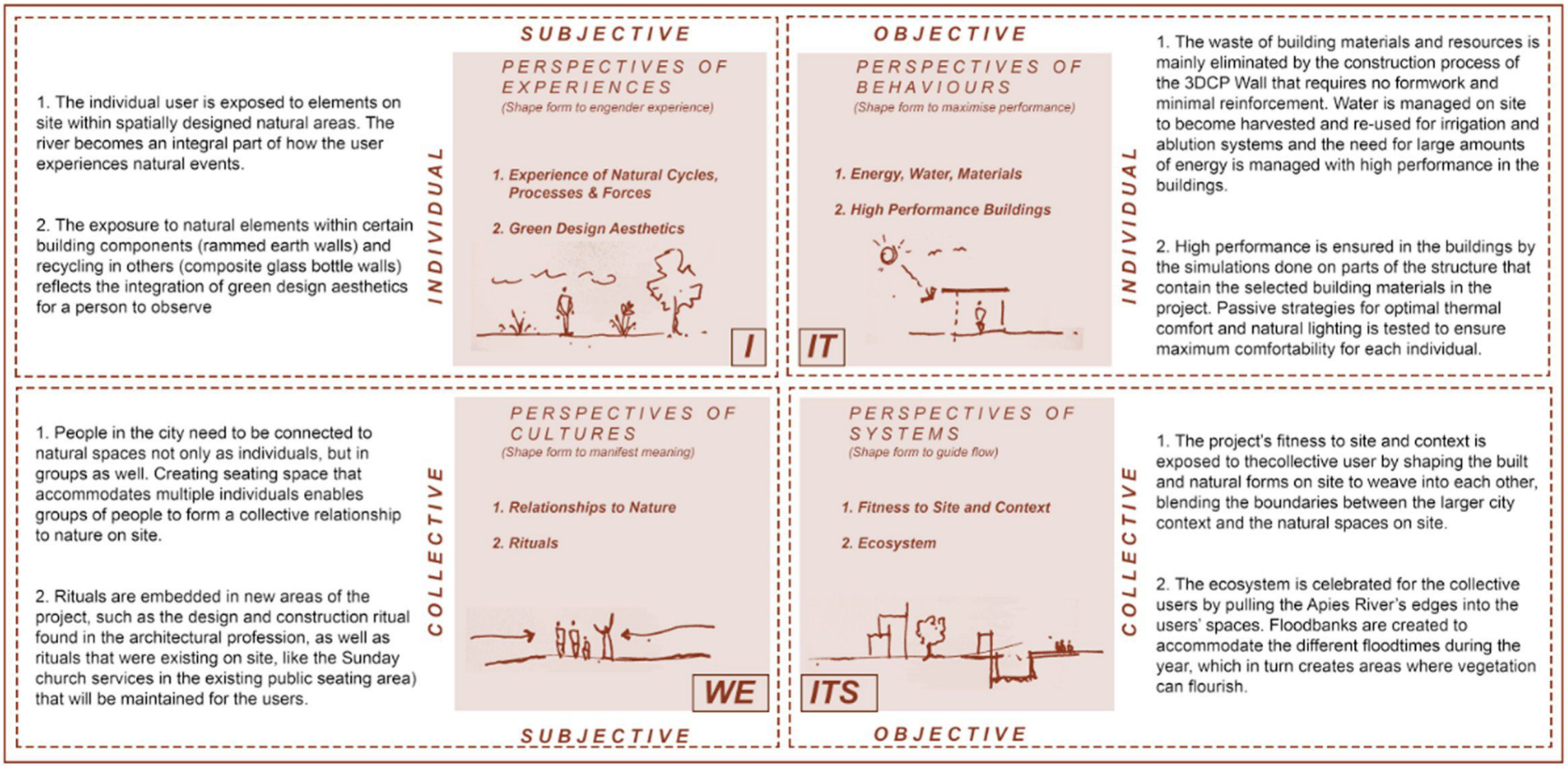


Figure 32: An adapted 'Quadrant Diagram' that is used to elaborate on the project's integrated design approach (Dekay, 2011)

After applying all the design informants and completing an extensive process of design iterations, the outcome of the major projects was settled. This project manifested in a way that adhered to the project intentions set out at the beginning, with spatial alterations in the process that eventually led to the final outcome.

Exhibition rooms that can also be used as meeting rooms, along with a bus stop and a reception building with an exterior and interior waiting space were placed on the Northern boundary. This adheres to the form generators of placing buildings on site boundaries, introducing people to the programme as they encounter the sidewalk. A new water channel is created at the back of these buildings to enhance passive cooling.

The next layer of built form is the workshop/exhibition space that spills out on the river banks with two viewing platforms that overlooks it from the reception building's side as well as from the opposite side of the building where the public can be seated. Opposite this building are the printing and coffee shop facilities that can also be accessed from Ockerse Street. An axis between these spaces are formed towards the lectur spaces.

Finally, the auditorium is situated behind the workshop space and slopes towards the river with retaining gabion walls in place, to provide a vista towards the natural space. Connected to the auditorium is a covered circulation/spill out space with a double storey building on the other side that contains additional lecturing space on the ground floor and the PIA's offices above. This was specifically designed for passive surveillance purposes.

At the very back there are carefully placed public ablutions that sit right at the end of the pedestrian bridge that connects the previously disconnected sides of the river on site. A water harvesting system is put in place to provide water to the ablution facilities that will be used in unison with the municipal water supply.

A double volume parking basement can be accessed from the Eastern Boundary in Ockerse Street, with an enclosed waste yard next to the parking entrance. Circulation reaches down into the basement, all the way up to the PIA offices, with a steel frame that covers the space. This creates vertical, yet visually permeable, mass that directs the users' attention towards the main gathering space on site. Navigation was considered when placing the linear buildings on site with the intent that people would meander through the buildings from the reception's side when attending a function. Alternatively, access is available from the pedestrian side or at selected spaces on the Eastern boundary that connect the furthest part of the site all the way to the river.

The design of the original public seating intervention that is located on the far Southern corner of the site connected to Madiba Drive, was kept in tact. This was done to respect and maintain the site's previous programmes that took place. This space's vegetation would, however, receive attention in order to restore the space to its full potential. The gabion art installation wall was removed, but the building technology was repeacted along the river banks to pay homage to the initial creator's intention.

The EBTs are mainly the 3D Concrete printed walls used in the auditorium and workshop's structures, as well as rammed earth walls that are placed in structures along the site boundaries and finally the composite walls that are connected to various spaces. EBTs have manifested in the design's use of construction material and processes as way of exhibiting the ethos behind the CPD conventions, which was informed by extensive research throughout the year.

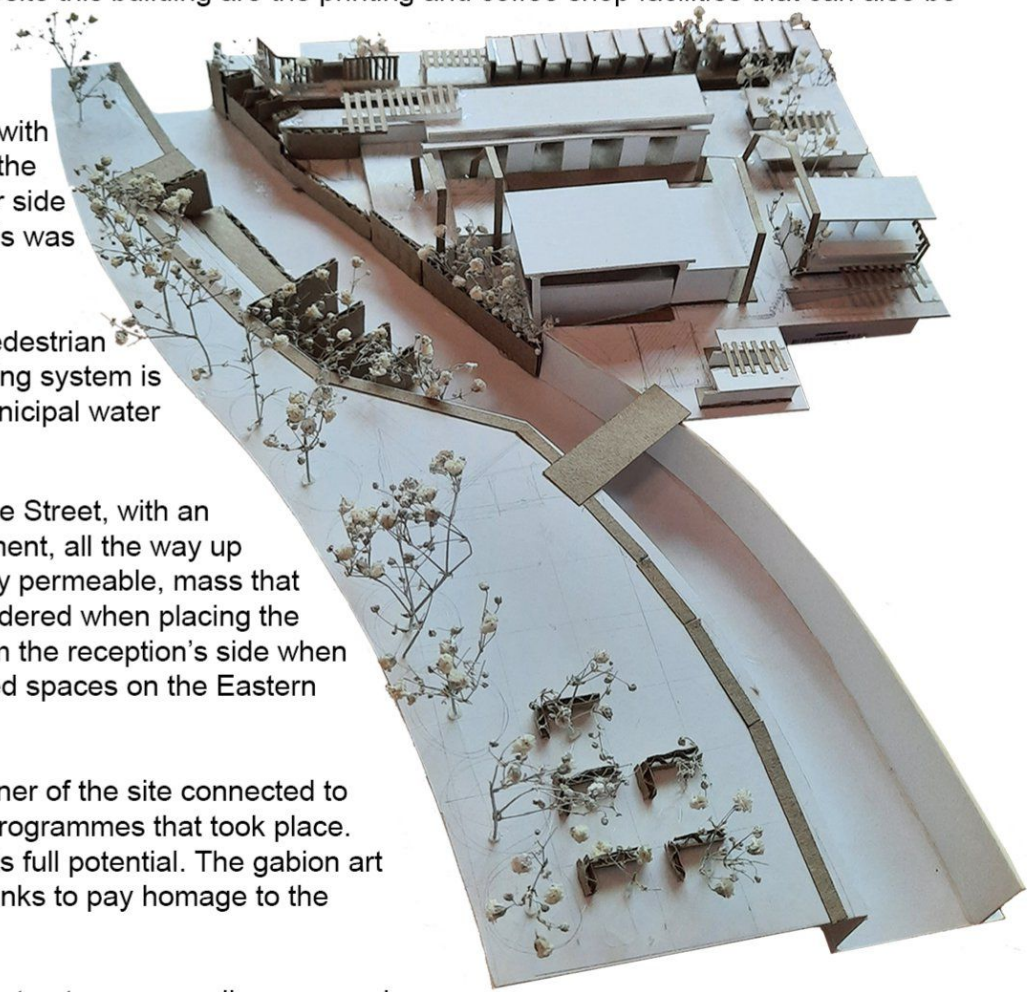
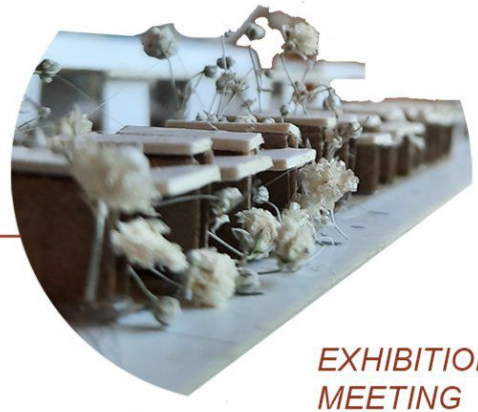


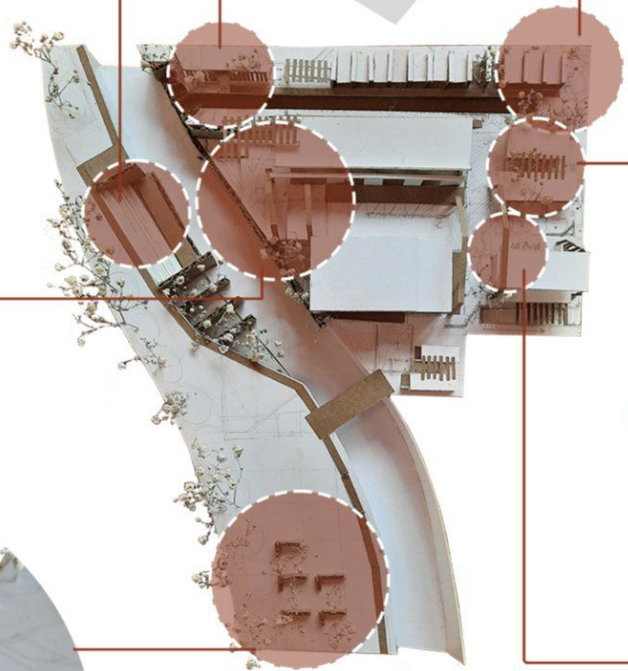
Figure 33: The 1:500 model of the entire project (Author, 2023)

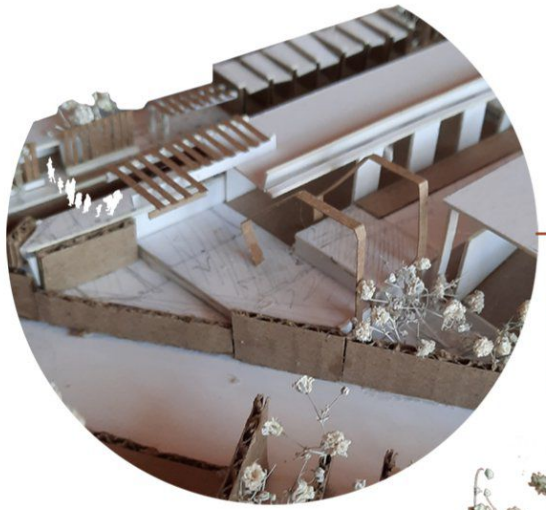
EXTERIOR VIEWING SEATS

RECEPTION

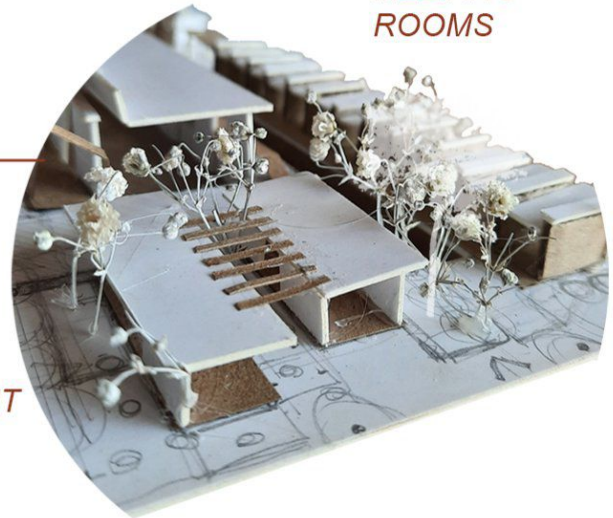


EXHIBITION/ MEETING ROOMS

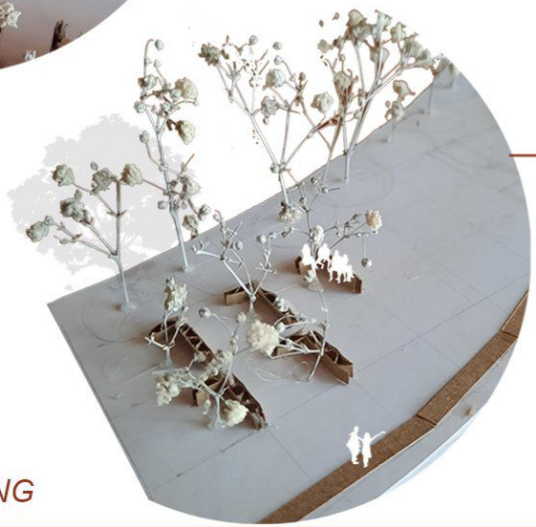




EXTERIOR WORKSHOP PLATFORM



COFFEE AND PRINT SHOP



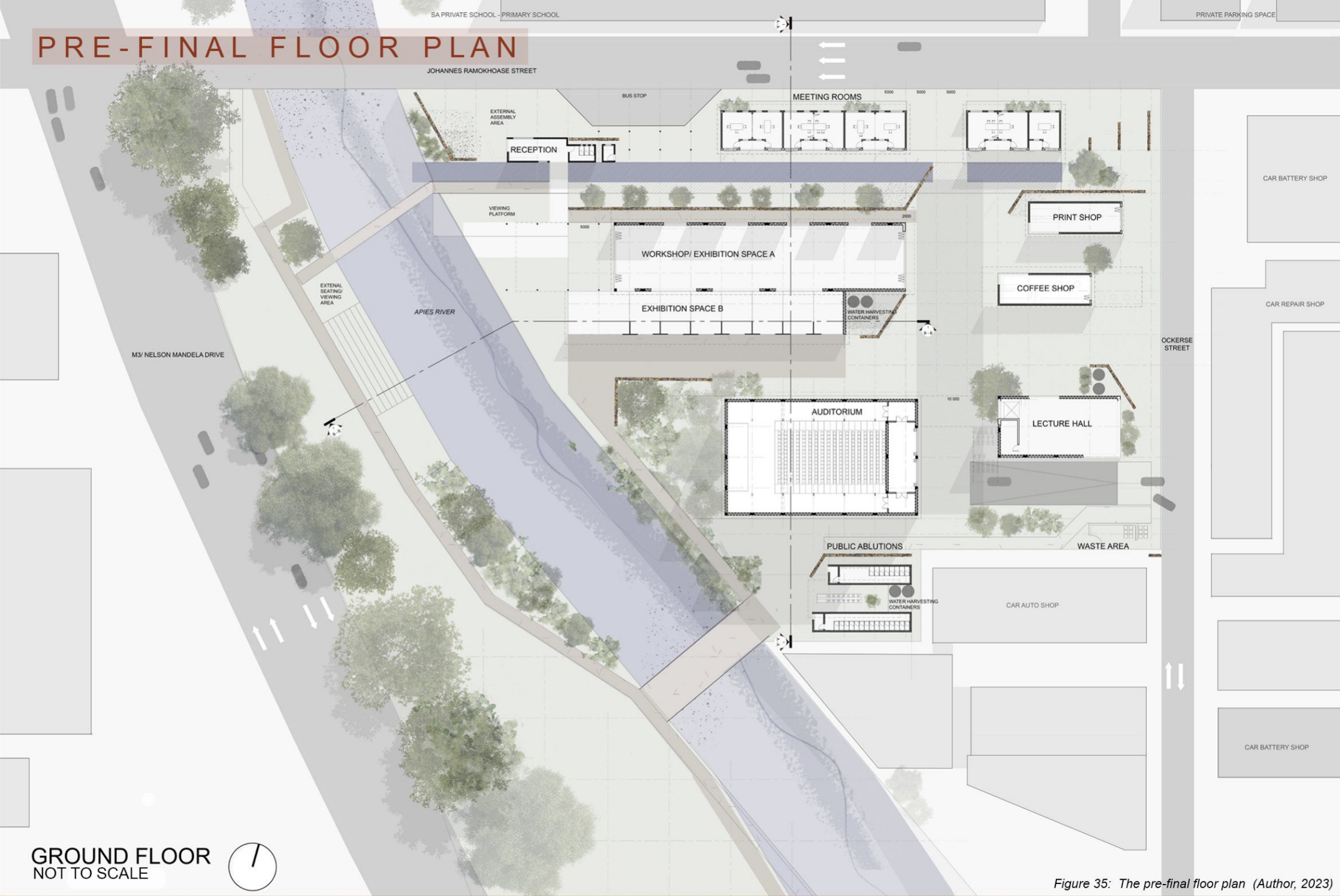
PUBLIC SEATING

TOP VIEW

OFFICES / LECTURE HALL

Figure 34: The 1:500 model with close-ups of different spaces on site (Author, 2023)

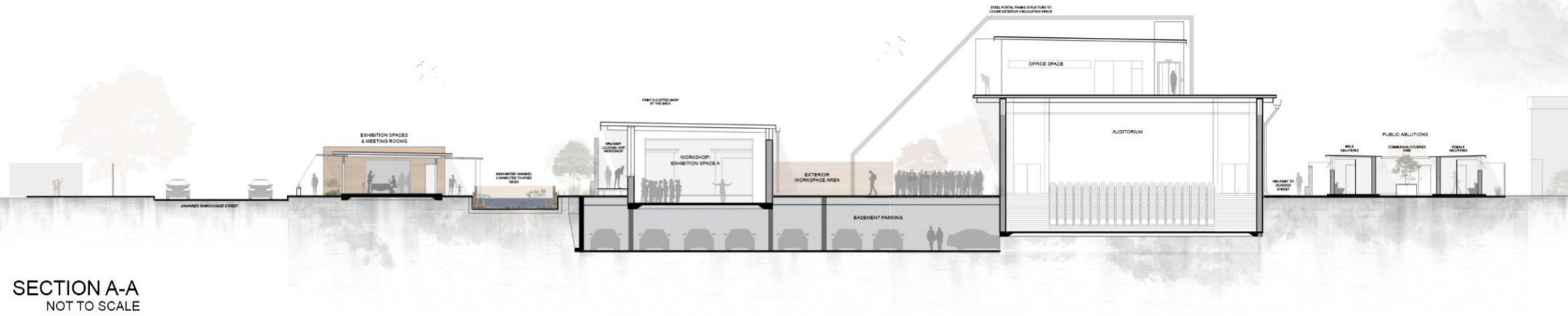
PRE-FINAL FLOOR PLAN



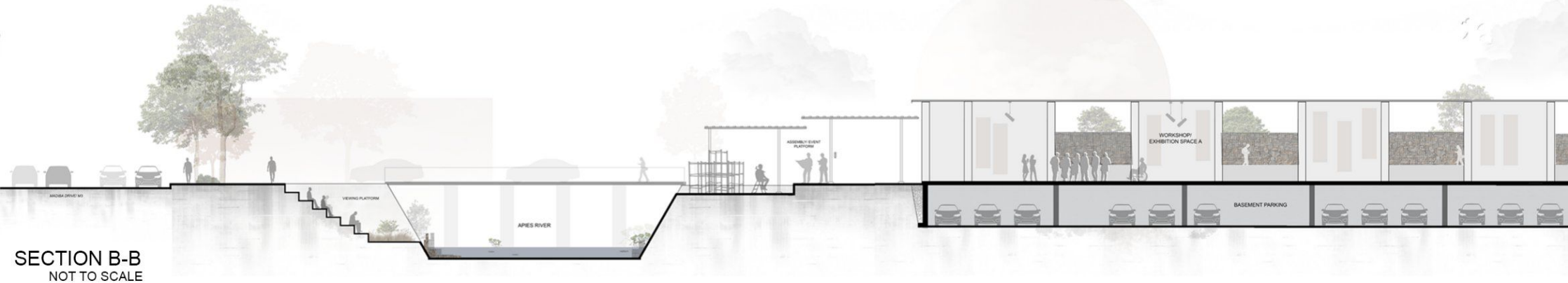
GROUND FLOOR
NOT TO SCALE

Figure 35: The pre-final floor plan (Author, 2023)

PRE-FINAL SECTIONS



SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

Figure 36: The pre-final sections (Author, 2023)

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