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Form and Landscape
Generating architectural form in Cullinan

Submitted in partial fulfillment of the requirements for the degree of Master of Architecture, MArch(Prof)
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Heritage & Cultural Landscapes

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Preface
Abstract

The landscape, industrial machine and human endeavour needs to be reconciled in Cullinan. The newly proposed group framework aims to do this by focussing on four nodes along a circular route which follows the circumference of the scar in the landscape. It is suggested that the once the mine (currently the only livelihood of the town) closes that a multi scalar network of craft industries, educational facilities, tourist attractions and agriculture would continue to support the town. This network doesn't just rely on one method on one scale, as the mine did, ensuring a more resilient support system (Ernstson, van der Leeuw, Redman, Meffert, Davis, Alfsen & Elmqvist 2010).

In this scheme, located at the soon to be closed No.1 shaft and headgear, it is proposed that if a resilient connection between town, users and landscape needs to be established by diversity of program, it might be necessary to also investigate a diverse generation of building form which reinforces this idea.

Gelernter (1995) identified five core theories on the generation of form. It is argued that the influences on form within these theories are either generated by the object (nature) or the subject (the mind). The generators of form found within the extant fabric of the study area was found to be mainly generated by influences from the physical world, thus if a diversity of form generation needs to be established, a form that was generated by intuition and links the emotions and mind of the user needs to be investigated within the design.

Following this, Romantic theories relating to the backlash to pure rationality is tapped into together with an understanding of the influence of the sublime on the mind of the user, and the emotional link it creates between the subject and object is used in the design and process. These theories have influence on the creation of spaces, form, and the relation to extant fabric in the new building. The concept uses and adapts sublime elements in the landscape and in the industrial machine to establish this emotional link.

Although program is not the main design generator of this project, it cannot be ignored and a bakery and baking school, and mill is proposed, as presents us with aspects that can be tapped into to enhance the experience of spaces as well as linking into all of the proposed networks of resilience as mentioned before.

The concept is drawn through into the technical exploration of the building, where the form is seen as a threshold between rationality and the sublime. Rational construction is decayed from the extant fabric into the landscape where natural materials are used more in the construction, and the structure is not as evident as before. This enhances the existing sublime elements of the site and strengthens the above mentioned emotional link between man and nature.

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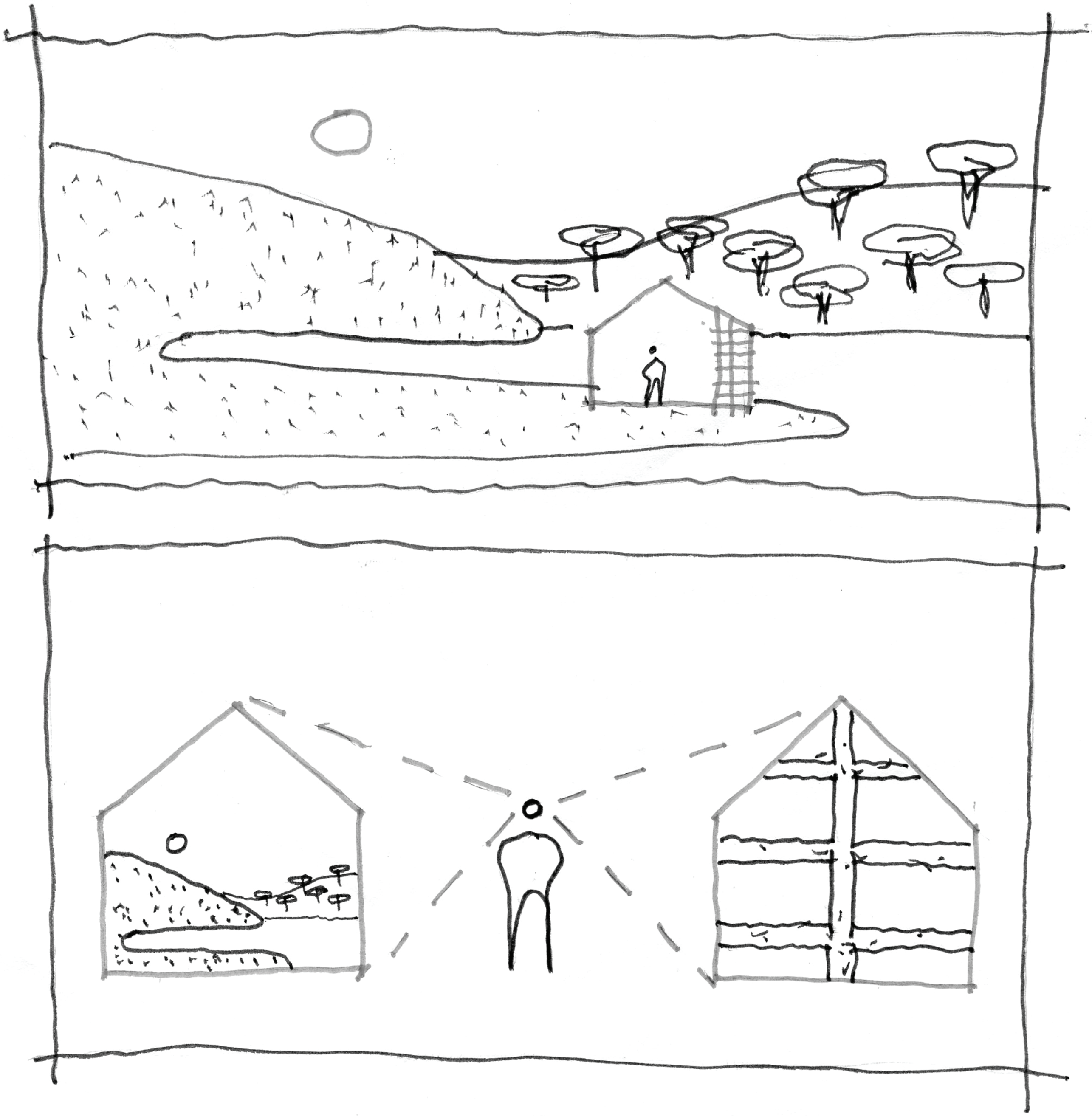


Figure 1.1. Form as link between man and landscape (Author 2014).

Chapter 1
Introduction

'…the beautiful object is the one which has the ideal structure of an object; it has the form of totality…' Mark Cousins (Hagan 2000: 472)

1.1 Problem statement and aim

The above comment by Mark Cousins on Aristotle's view of the whole gives us clue to the pre 18th century notion of the role of form in architecture, echoed by the Vitruvian tenets of 'firmitas', 'commoditas' and 'venustas' - 'structural soundness, appropriateness to use and beauty' (Hagan 2000: 473). It has come to my attention that the investigation of form in contemporary architecture (at least in my own education and work experience) is often seen as unnecessary. A building's merit is often judged on how effective it manages to use resources and with methods focussing on the measurable.

Has the resource and uses of building form and composition been neglected in recent years, or can we again turn to these practices to enrich the built environment? A building's relationship with the natural landscape is surely more than just how effectively it manages the resources drawn from the landscape. The relationship between the form of the building and its context could also be seen as a resource, for use in a further link between man and nature, a link not just defined by use of physical resources, but also perhaps defined by pleasure and emotion caused by the relationship between form and landscape.

This exploration of form as a resource in linking the user with the landscape has also been neglected by me in my previous projects, which were approached very rationally in the past. The emotional link that building form can establish between the user and its context has always interested me however. This dissertation then aims to explore there possibility of building form being used as a resource in architecture to connect the user with his/her context. It will also be useful as project to help me grow as a designer, and to explore the less rational aspects of design, the ones I'm not yet comfortable with as an architect.

Figure 1.2. Cullinan's sublime landscape (Author 2014).

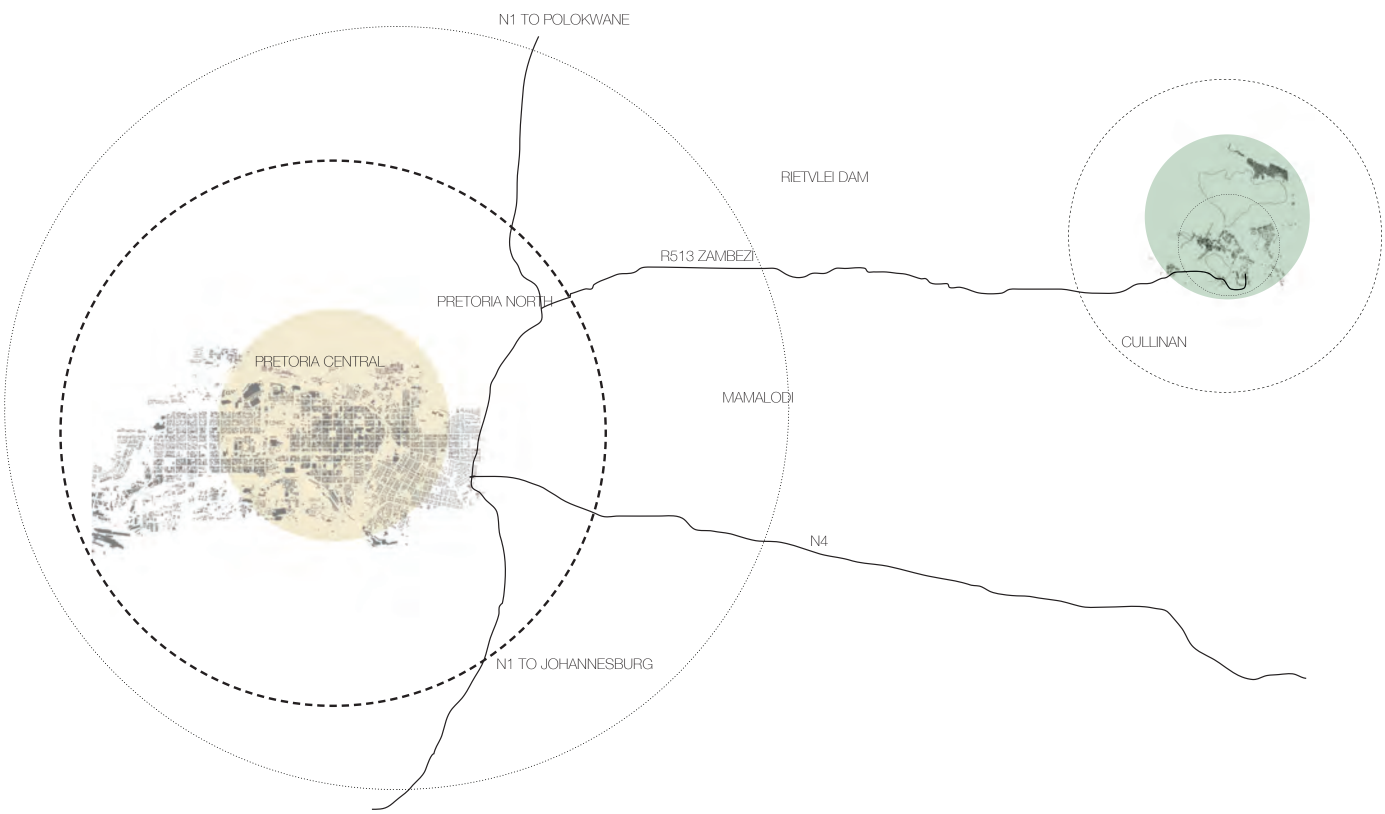
1.2 Why Cullinan?

The landscape of the once agricultural settlement of Cullinan is defined by the Diamond mining industry. The Industrial mining machine, designed solely with rational considerations of efficiency and purpose also defines the Enlightenment's formal relationship with the landscape.

Built forms which can be defined by Hannes Meyer's formula for architecture (architecture = function x economics) do little in the way of interfacing the scale of the vast natural landscape with the small scale of the town (St John Wilson 2007: 72).

Cullinan presents us with an opportunity to explore the relation of form as interface between the natural landscape and man. Here we can explore how scars, and industrial structures left in the landscape (which in themselves have become picturesque and sublime), can be navigated through the exploration of a building form that is not generated solely through rational considerations.

CULLINAN IN RELATION TO PRETORIA



Chapter 2
The context: Cullinan

The majority of the following chapter and research accompanying it was produced by the Cullinan group of 2014. The group consists of Nikita Edwards, Paige du Toit, Marcel Mattheüs, Natasha Laurent, Walter Raubenheimer and Hugo van Niekerk.

2.1 Locality

Cullinan is a small town located to the Northeast of Pretoria. It can be reached via motor vehicle by driving east on the R513, or by driving East on the N4 and then transferring to the R515 travelling north (Figure 2.2). The drive to Cullinan via either takes about 40 minutes, which was kept in mind whilst developing the new urban vision for the town, as this commuting time means Cullinan is a distance from Pretoria that is considered viable for commuting by most residents of Gauteng (similar to the commuting time between Pretoria and Midrand).

Another means of reaching Cullinan is via railway line. The town has a small railway station, but unfortunately only historical tourist trains operate on the line between Hermanstad station and Cullinan station (Friends of the Rail 2014) and only on public holidays and a few Sundays. Nevertheless the railway line represents a means of travel and commute between Cullinan and Pretoria, especially considering that walking is a viable means of transport in Cullinan due to its small size.

The town itself is defined by five major landmarks situated around it (Figures 2.3 – 2.7). When entering the town by car these landmarks go mostly unnoticed. This fact was also taken into consideration when developing the urban vision. These landmarks are the open pit (Figure 2.3), the mine (Figure 2.4) which will referred to as “the machine” in our urban vision, the nature reserve (Figure 2.5), the No.7 tailings dam (Figure 2.6), and the old mining compound (Figure 2.7).

Figure 2.1. (top left) An aerial view of Cullinan (wikipedia.org 2011).

Figure 2.2. (bottom left) The location of Cullinan (Cullinan study group 2014).

2.1.1 The open pit.

The open pit, which is also referred to by the people of the town as "the hole" is a massive scar that has been left in the Highveld landscape due to industrial input by the mining machine. The hole is located to the Southwest of Oak avenue (the main road running through the town), with the mine and town's buildings scattered around its North-eastern edge (Figure 2.3). The pit is 1000m long, 500m wide and 450m deep – 4 times the size of the open pit at Kimberly – with an average wall slope of 85 degrees (Lincoln 2011: 142). A 100m, hundred year safety line runs around the circumference of the hole. Despite the size of the pit, it is hard to actually see it from any point within the town due to this safety line.

2.1.2 The working mine.

Originally named the Premier Diamond Mine and re-named the "Cullinan Diamond Mine" in 2003 (Figure 2.4), the working mine sits atop a diamond pipe which has a surface area of 32ha. After the mine stopped operations during World War II underground mining commenced development after open pit processes were not viable any longer, resulting in an accessible underground tunnel network of over 416km (Lincoln 2011: 142). The mine changed hands from DeBeers to Petra Diamonds in 2008 and has approximately 20 years of financially viable operation left (Lincoln 2011: 138), it is this closure of the mine and the town's livelihood that the urban vision has to respond to.

VIEW FROM EDGE OF TOWN ONTO HOLE

Figure 2.3. The open pit (Cullinan study group 2014).

VIEW OF WORKING DIAMOND MINE AND WASH

SIGNIFICANT L

E BIG HOLE

: hole is as a result of the early open pit mining and is about 1km x 1.5km wide, km deep. The side walls average at an angle of 85 ° and as such, rock fall happens ut four times a year.

HING PLANT

MACHINE INPUT

PETRA DIAMOND MINE

Originally the Premier Diamond mine, it changed hands from De Beers in 2008. The mine has an estimated 18 years of financially viable operation left. Currently, the mine dumps are also being re-processed as they are likely to still contain diamonds.

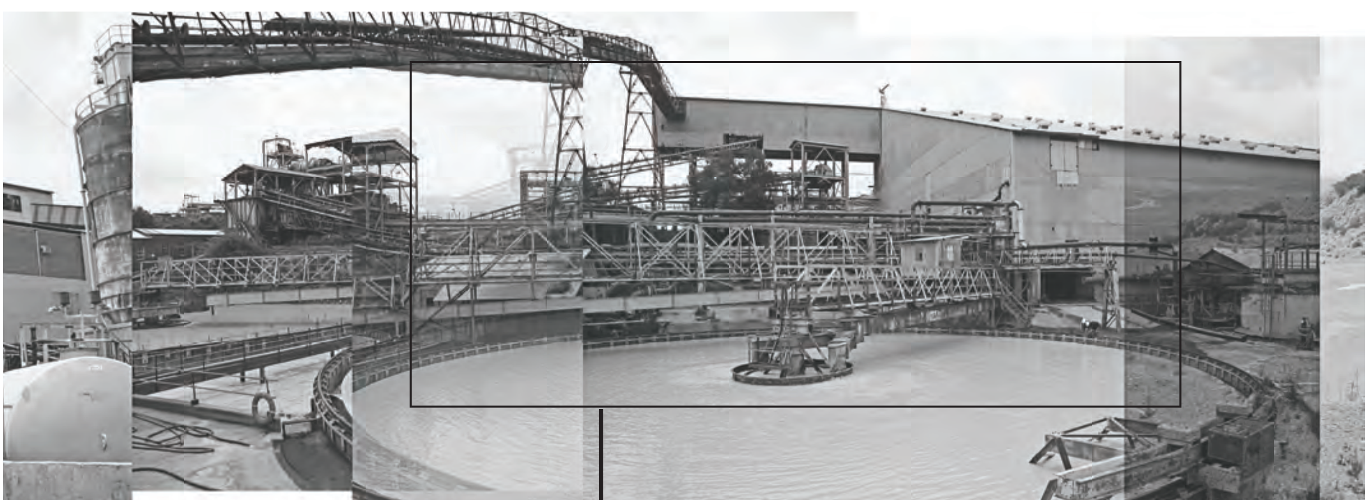


Figure 2.4. The working mine (Cullinan study group 2014).

LANDMARK

MACHINE IN PUREST FORM

2.1.3 The nature reserve.

To the North of the working mine and surrounding Cullinan lies the Premier Game Park (Figure 2.5). This park contains a diversity of fauna and flora outlined in an environmental management report and environmental impact assessment done by Shangoni Management Services (Pty) Ltd in 2012 for the Petra Diamond mine. What is of interest here is that the report defines the strategy for when the mine closes to be the dismantling of mining equipment (except for major structures like the mining shafts) and the extension of this reserve into the area occupied by the working mine. It is hoped that this will lead to the reclamation of this area by the aforementioned fauna and flora. Although this strategy is meticulously defined in the report and different strategies for management of the reclamation are discussed, little is to be done about the livelihood of the town when the mine closes. It is the intention that the proposed urban vision presents an alternative to this strategy.

2.1.4 The No.7 tailings dam.

Located to the North of the town and South of Refilwe township is the No.7 fine tailings dam (Figure 2.6). This is a large water body with an area of 947ha is fed from surface runoff and mine operations. The environmental impact assessment by Shangoni Management Services (Pty) Ltd (2012: 132) claims that although the water quality of the dam is not as toxic as that of a gold mine's tailings, it still has several problems that impact the area around Cullinan. These include low biodiversity in and around the catchment area, the effluent pollution of groundwater and overflow into adjacent sewage treatment plants. The main study area for the suggested urban vision and architectural intervention is limited to the South of the town and around the open pit, and various strategies for the mitigation of the problems caused by the No.7 tailings dam is outlined by the above mentioned environmental impact assessment. For the purposes of this study it will be assumed that these strategies will be successfully implemented after the decommissioning of the mine.

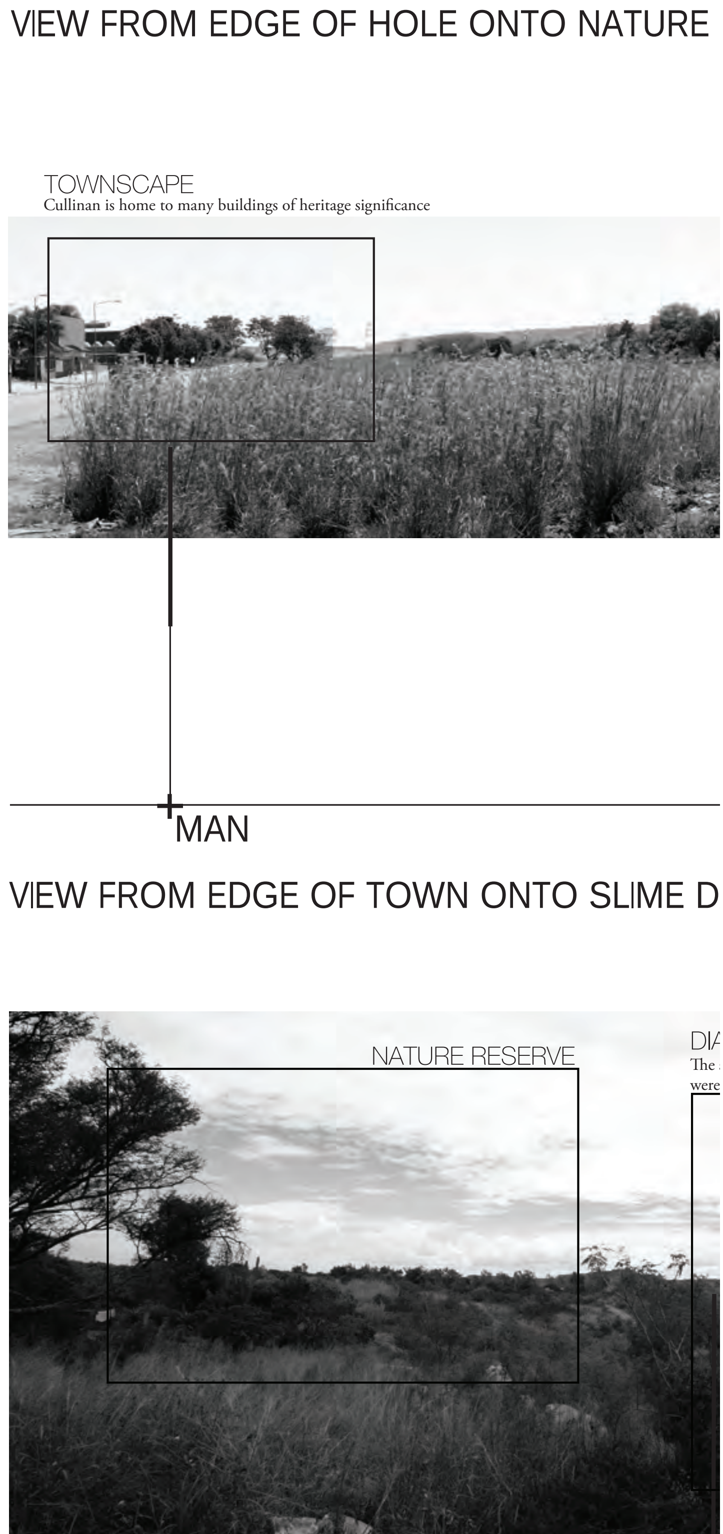


Figure 2.5. The No.7 tailings dam (Cullinan study group 2014).

RESERVE AND SURROUNDS

PROTECTED NATURE RESERVE
Cullinan is surrounded be fertile vallys and diverse fauna and flora

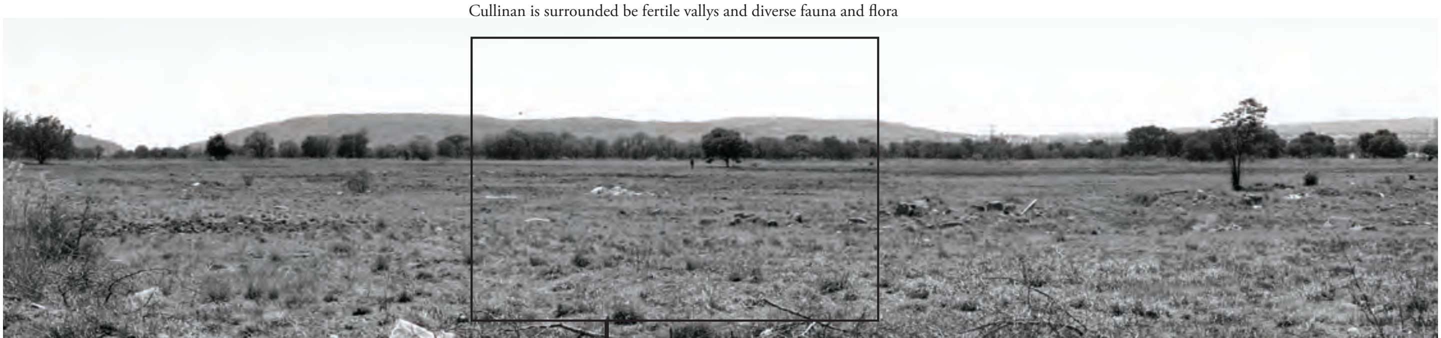
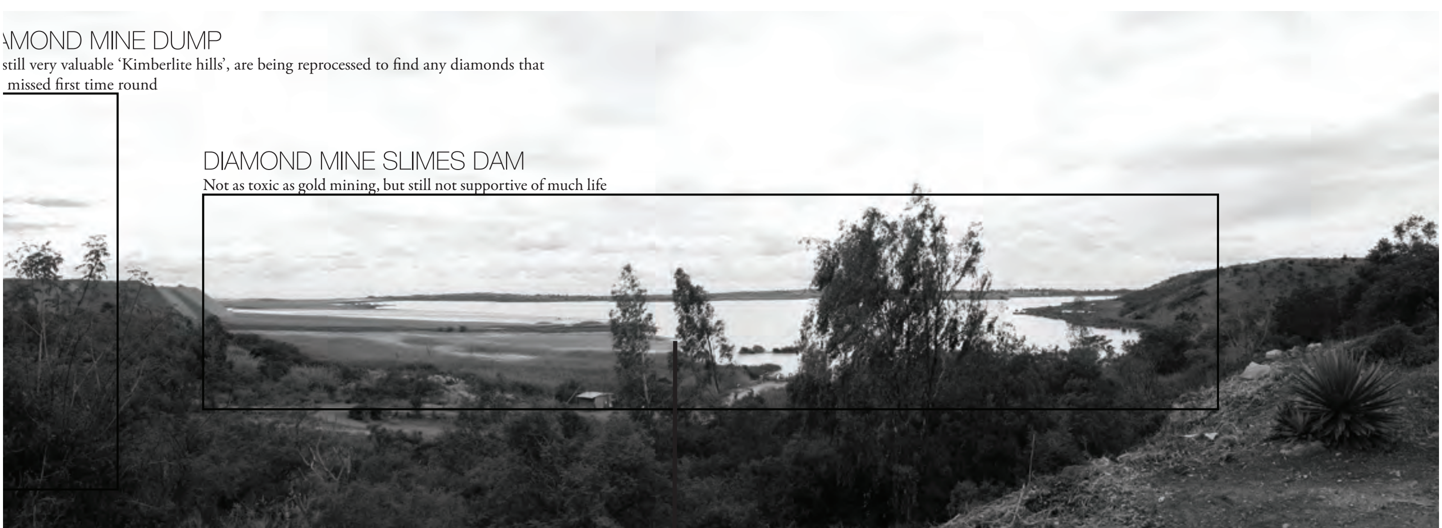


Figure 2.6. The nature reserve (Cullinan study group 2014).

NATURE UNTOUCHED

AM



MACHINE WASTE OUTPUT

VIEW NEAR HOLE AND COMPOUND

2.1.5 The old compound

Before mechanisation of the mine, workers were recruited from all over the country. These workers were housed in the compounds (Figure 2.7) which are located to the South of the open pit. Before these compounds were closed in 1973 they housed as many as 15000 workers at a time (Lincoln 2011: 115). Although these compounds are still on mine property today, they are largely neglected. Many of the structures of the compound are also at risk as they lie within the 100m, 100 year break line and will likely fall into the pit if the problem of landfalls are not addressed.

MINING HEADGEAR
Decommissioned in the 80's and now in danger of dissapearing into the ho

REMNANTS OF THE M

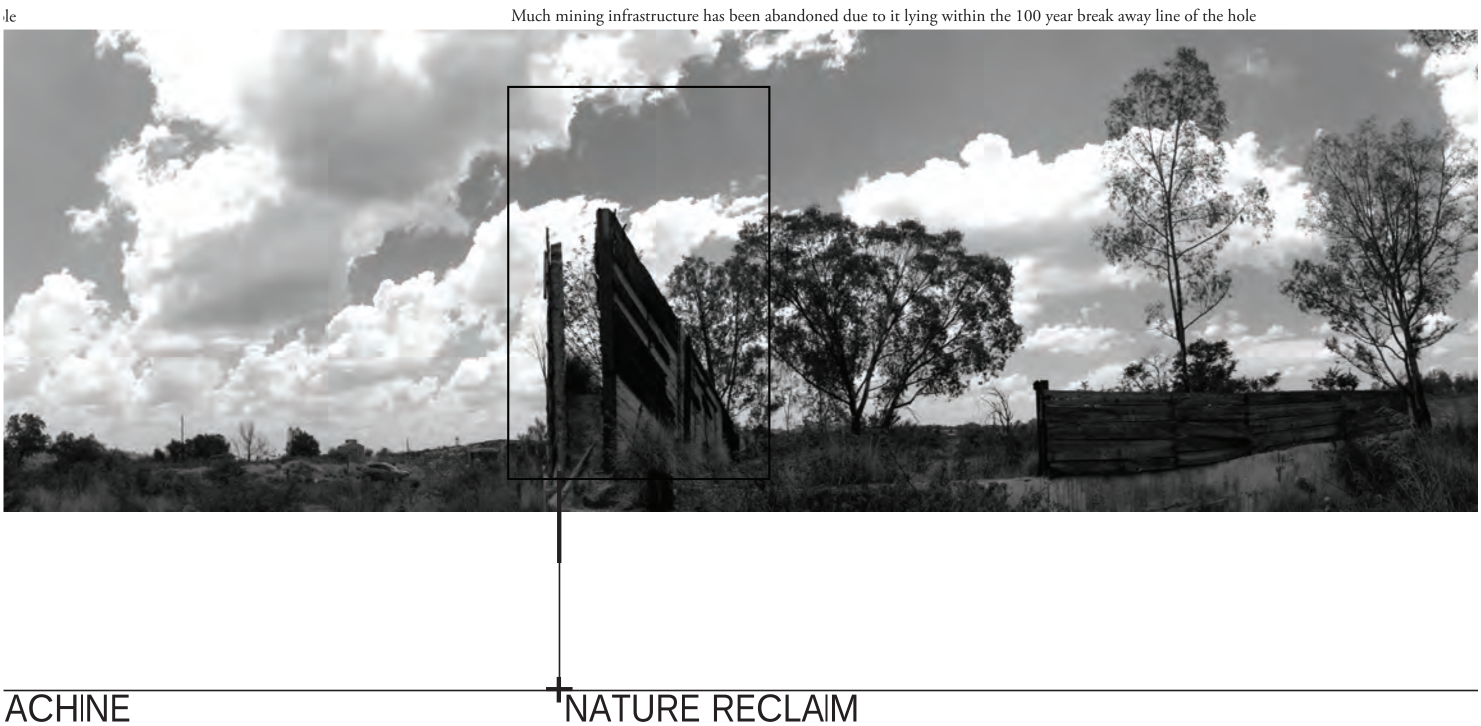


Figure 2.7. The old compound (Cullinan study group 2014).

2.2 The History of Cullinan

A diagram showing the timeline of the development of the town of Cullinan (Figure 2.8 – 2.14) has been made by the Cullinan study group * (information for the diagram was obtained in Lincoln [2011]). This timeline shows the important dates in the town's history and the development of the industrial machine.

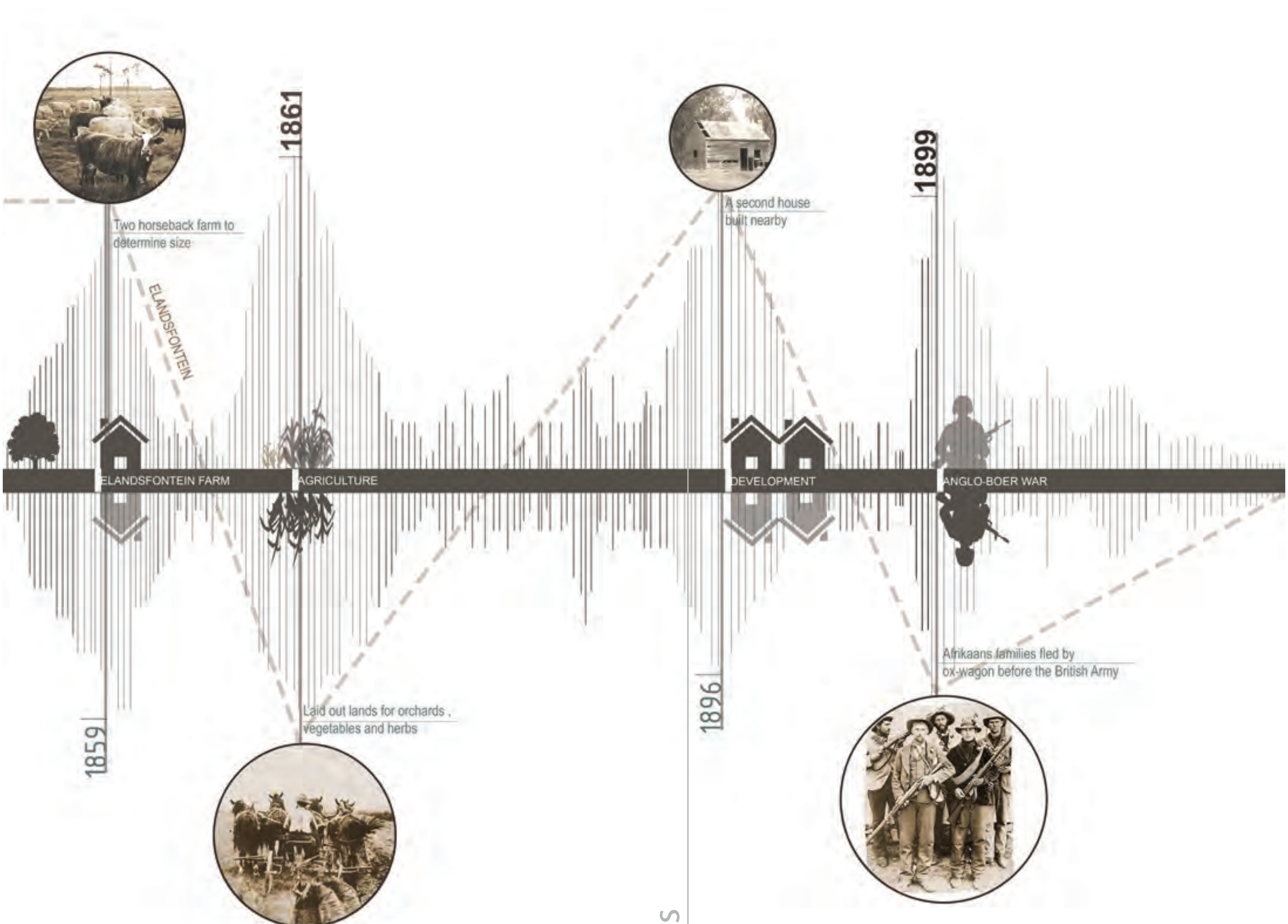


Figure 2.8. The history of Cullinan part 1 (Cullinan study group 2014).

The group consists of Nikita Edwards, Paige du Toit, Marcel Mattheüs, Natasha Laurent and Walter Raubenheimer and Hugo van Niekerk.

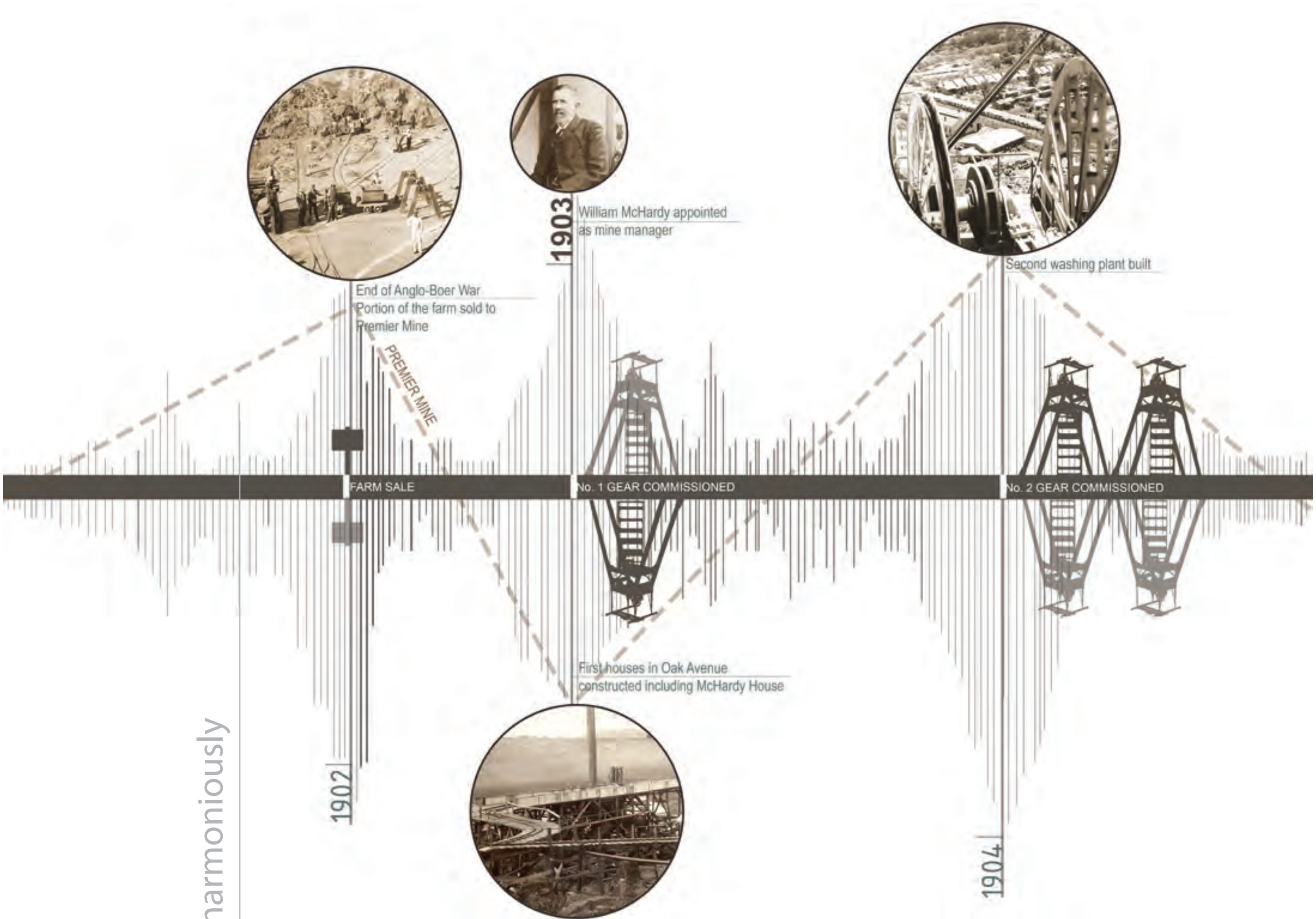


Figure 2.9. The history of Cullinan part 2 (Cullinan study group 2014).

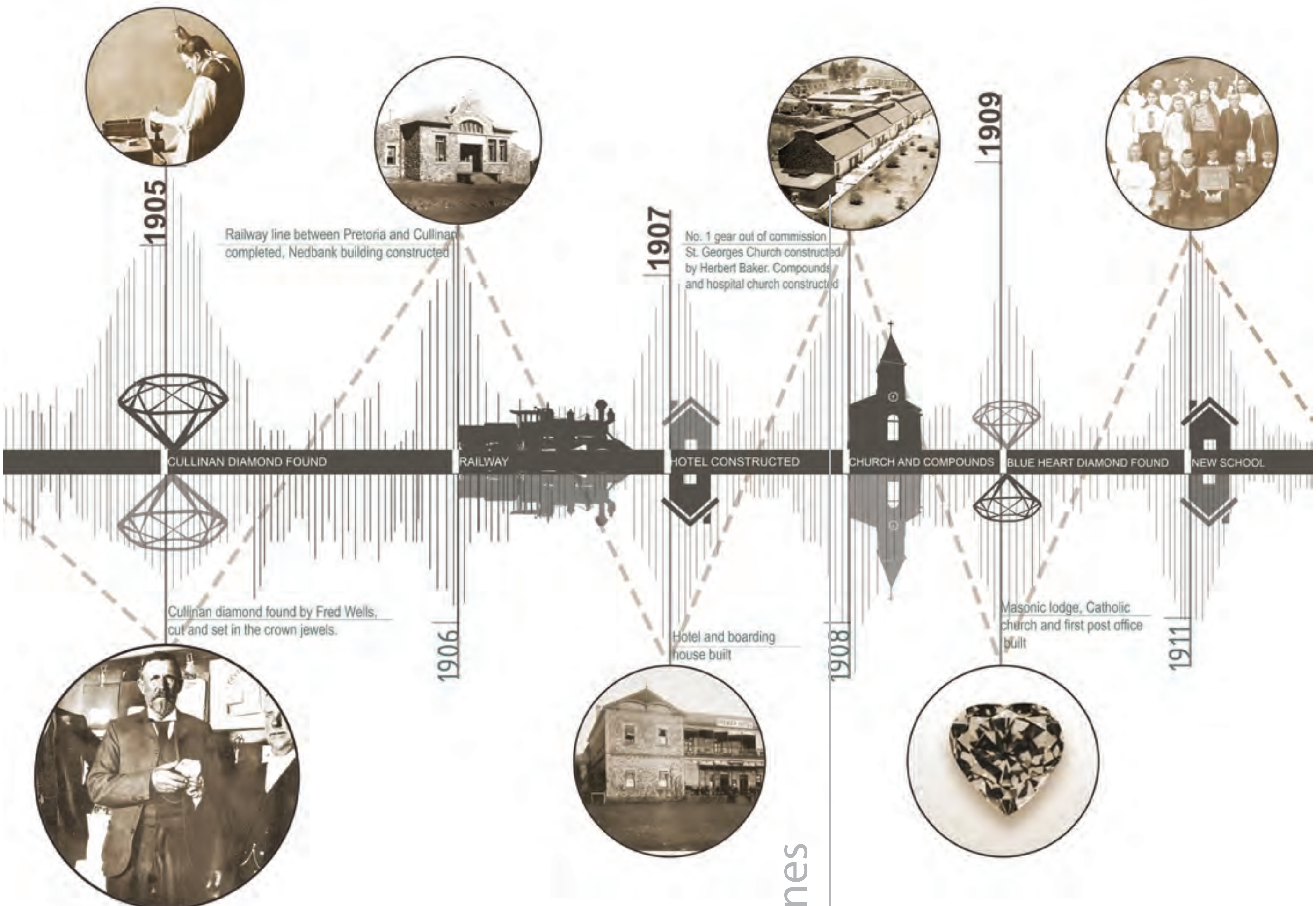


Figure 2.10. The history of Cullinan part 3 (Cullinan study group 2014).

Machine intervenes

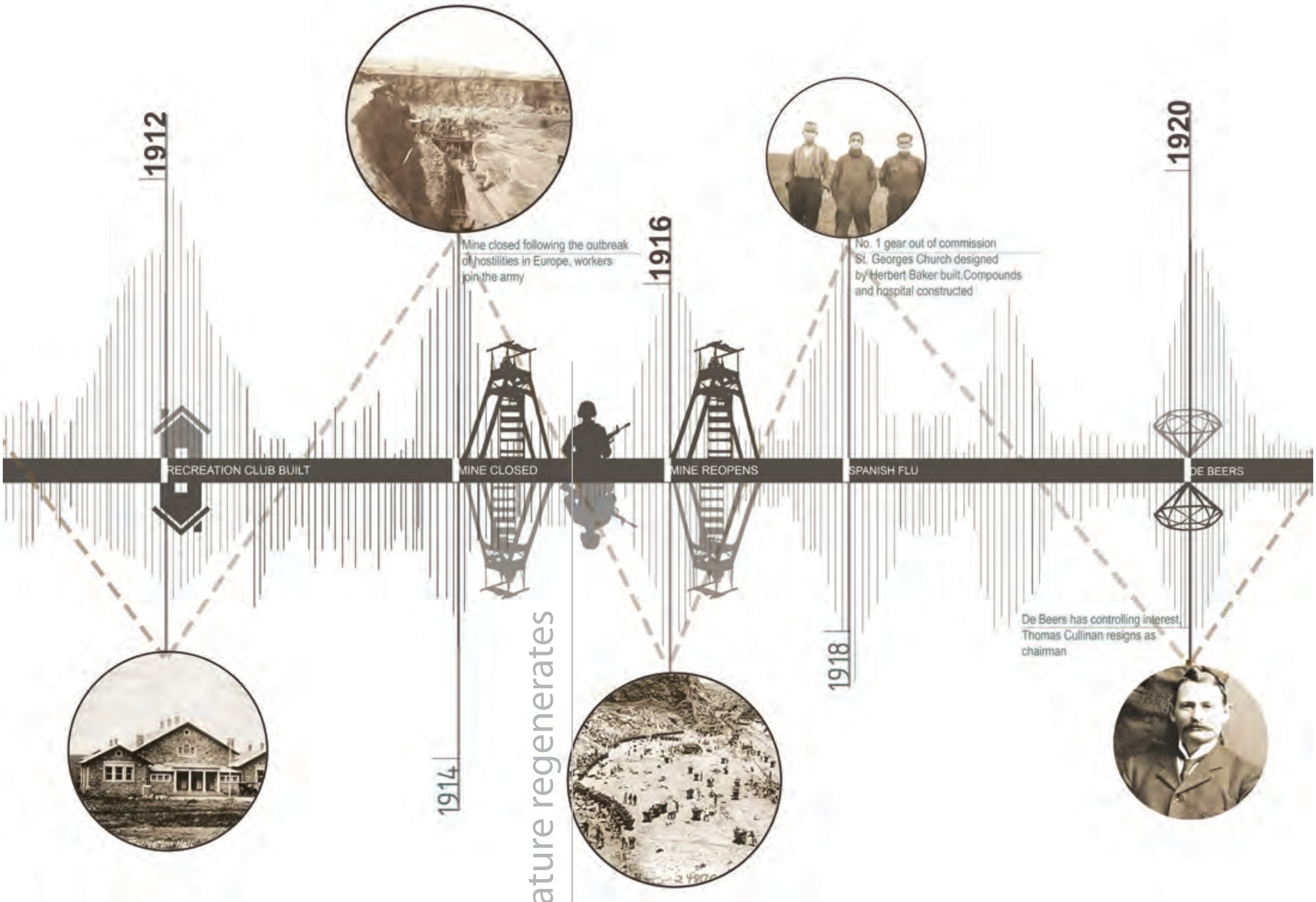


Figure 2.11. The history of Cullinan part 4 (Cullinan study group 2014).

Machine Dormant, Nature regenerates

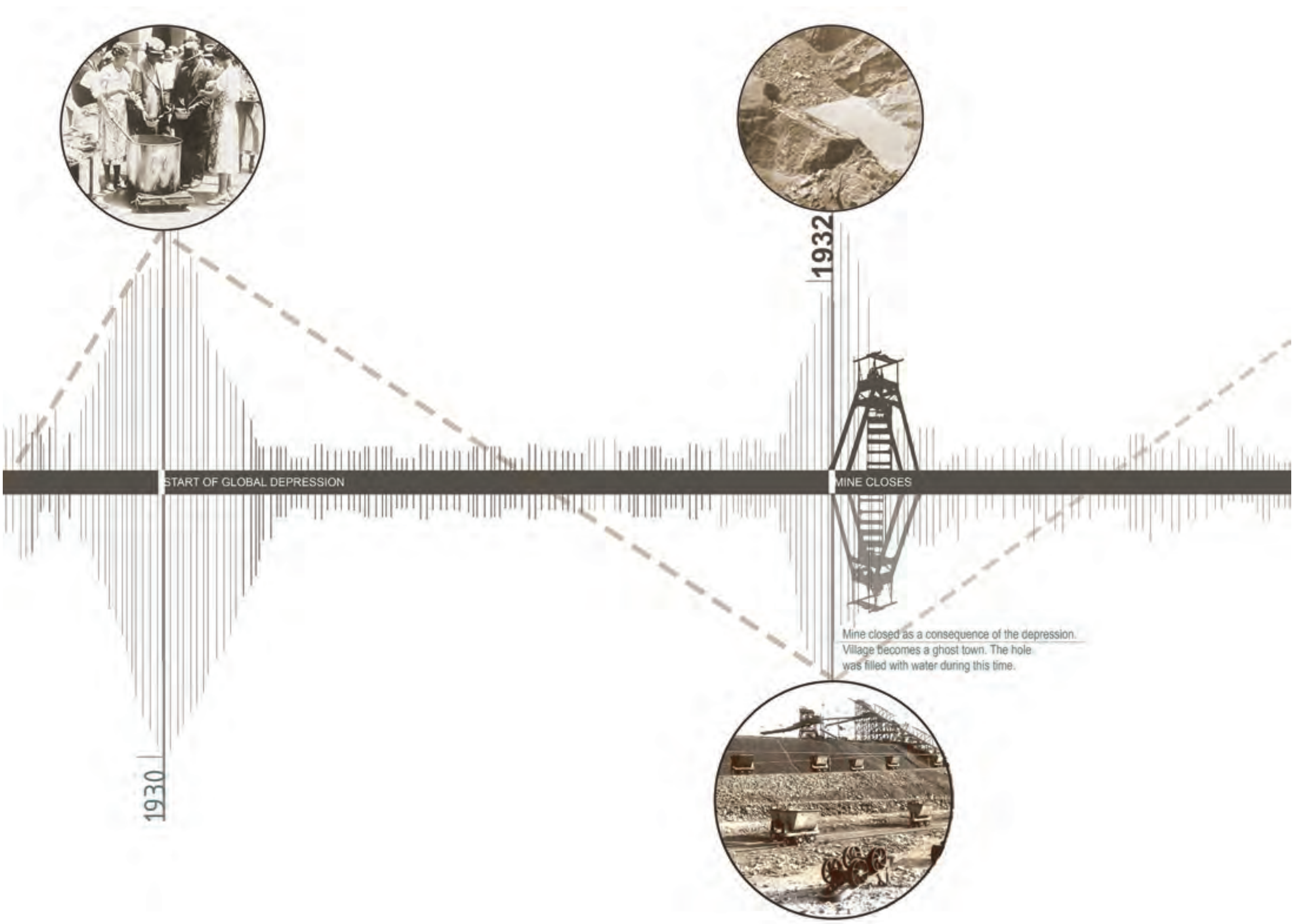


Figure 2.12. The history of Cullinan part 5 (Cullinan study group 2014).

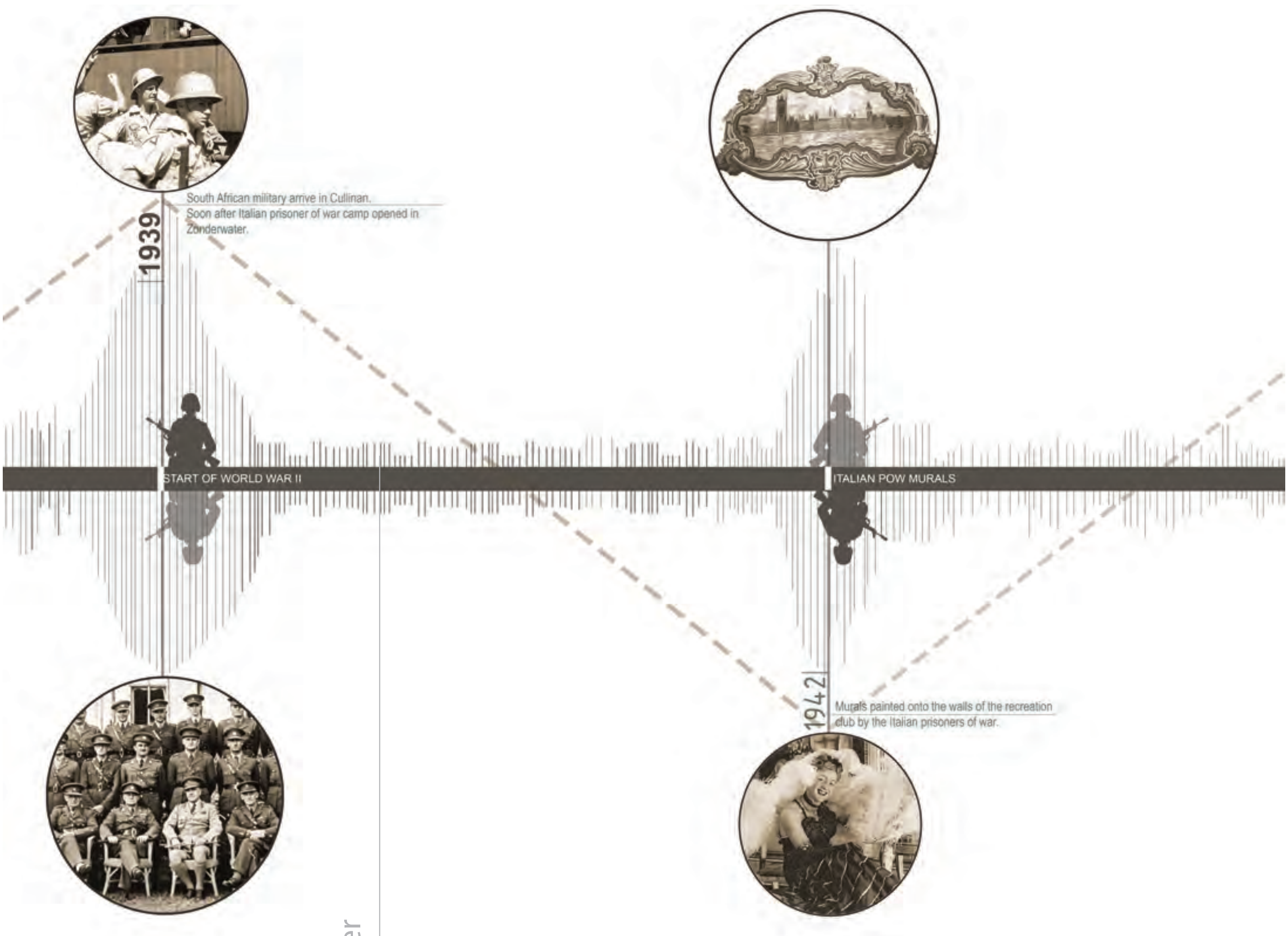


Figure 2.13. The History of Cullinan part 6 (Cullinan study group 2014).

Man displays power

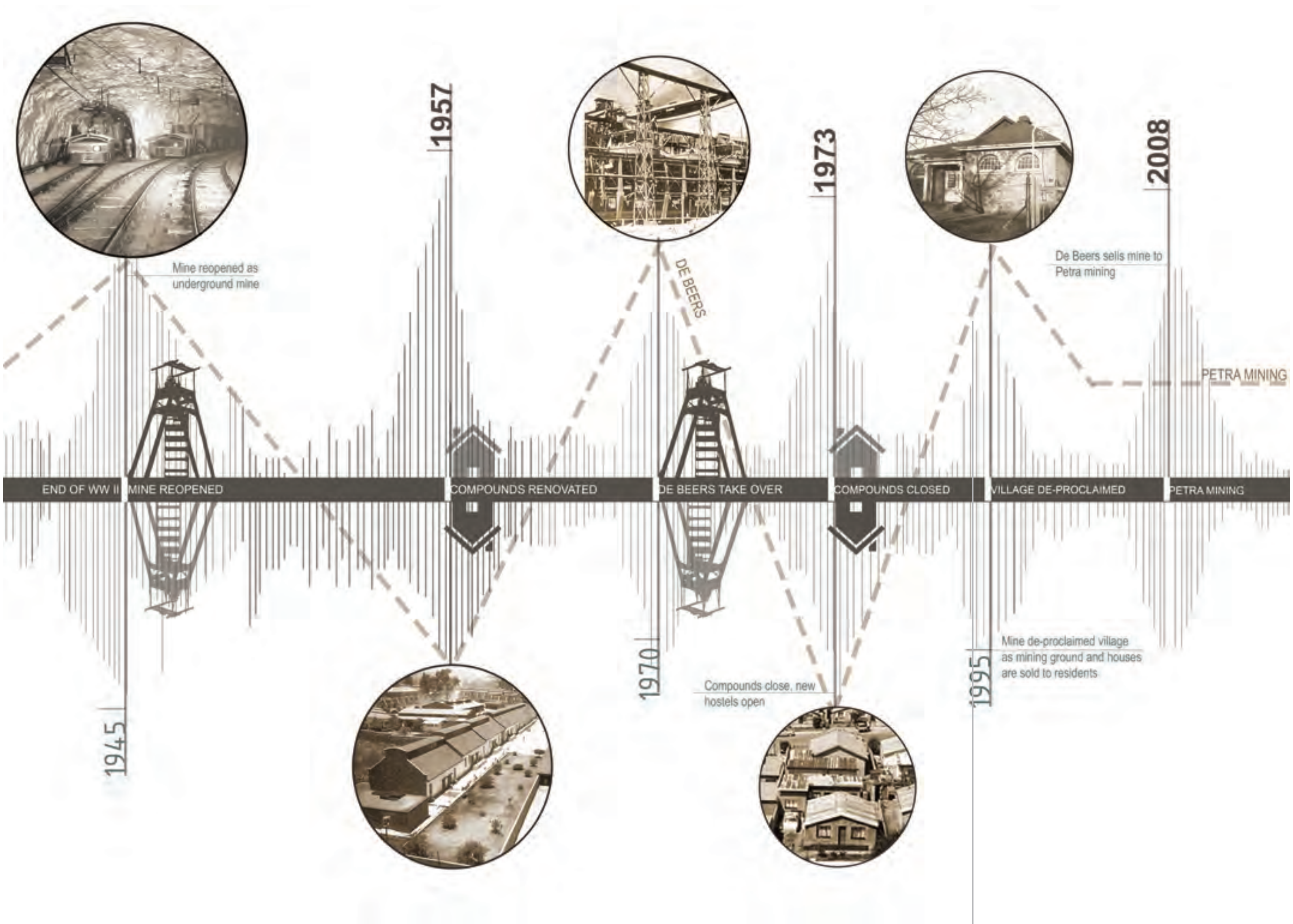


Figure 2.14. The history of Cullinan part 7 (Cullinan study group 2014).

Machine Dominates

Using this information about the history of the town and through the study of aerial photographs obtained from Petra Diamonds in Cullinan, diagrams of the town's growth plan has been made (Figures 2.15 – 2.17). These photographs were returned to Petra Diamonds, but were scanned and photographed to be archived at the University of Pretoria.

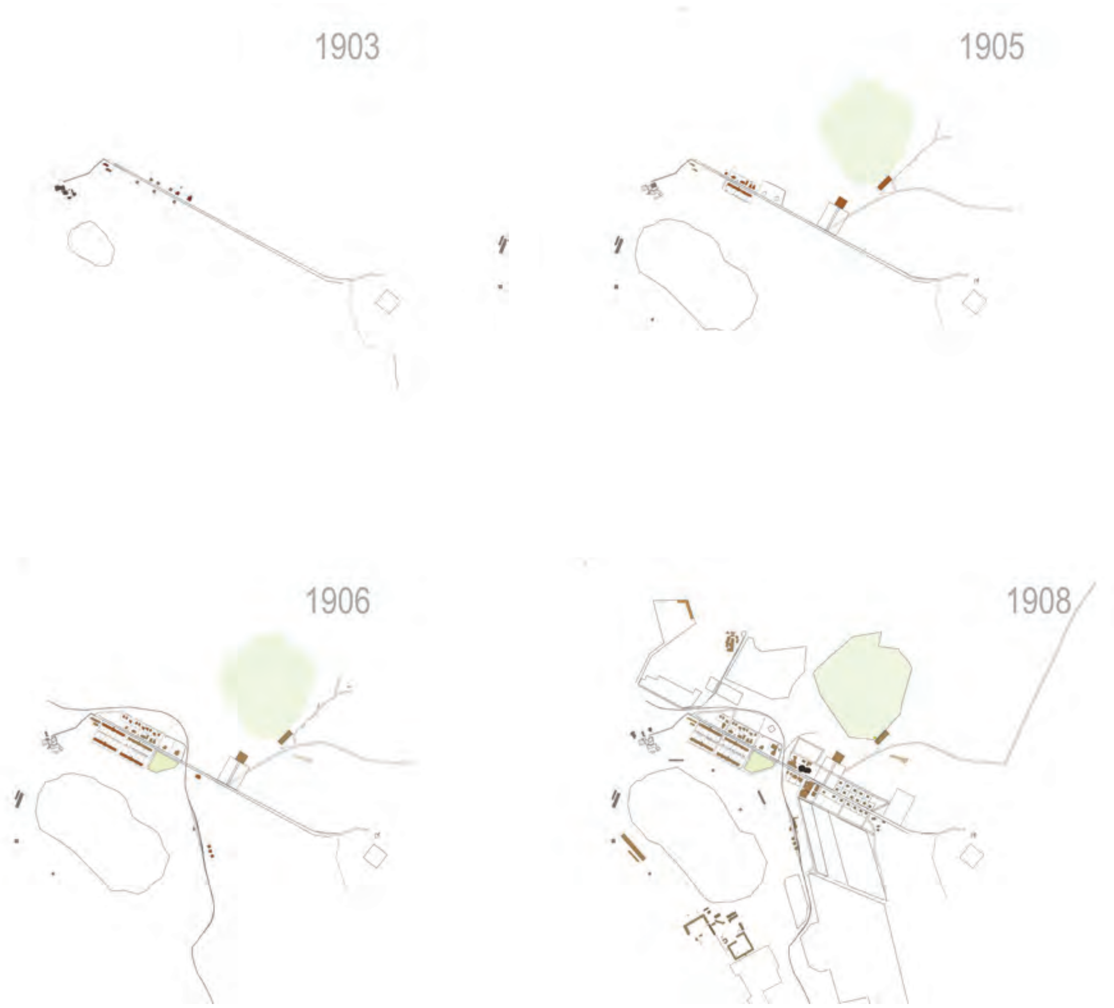


Figure 2.15. The growth of Cullinan part 1 (Cullinan study group 2014).

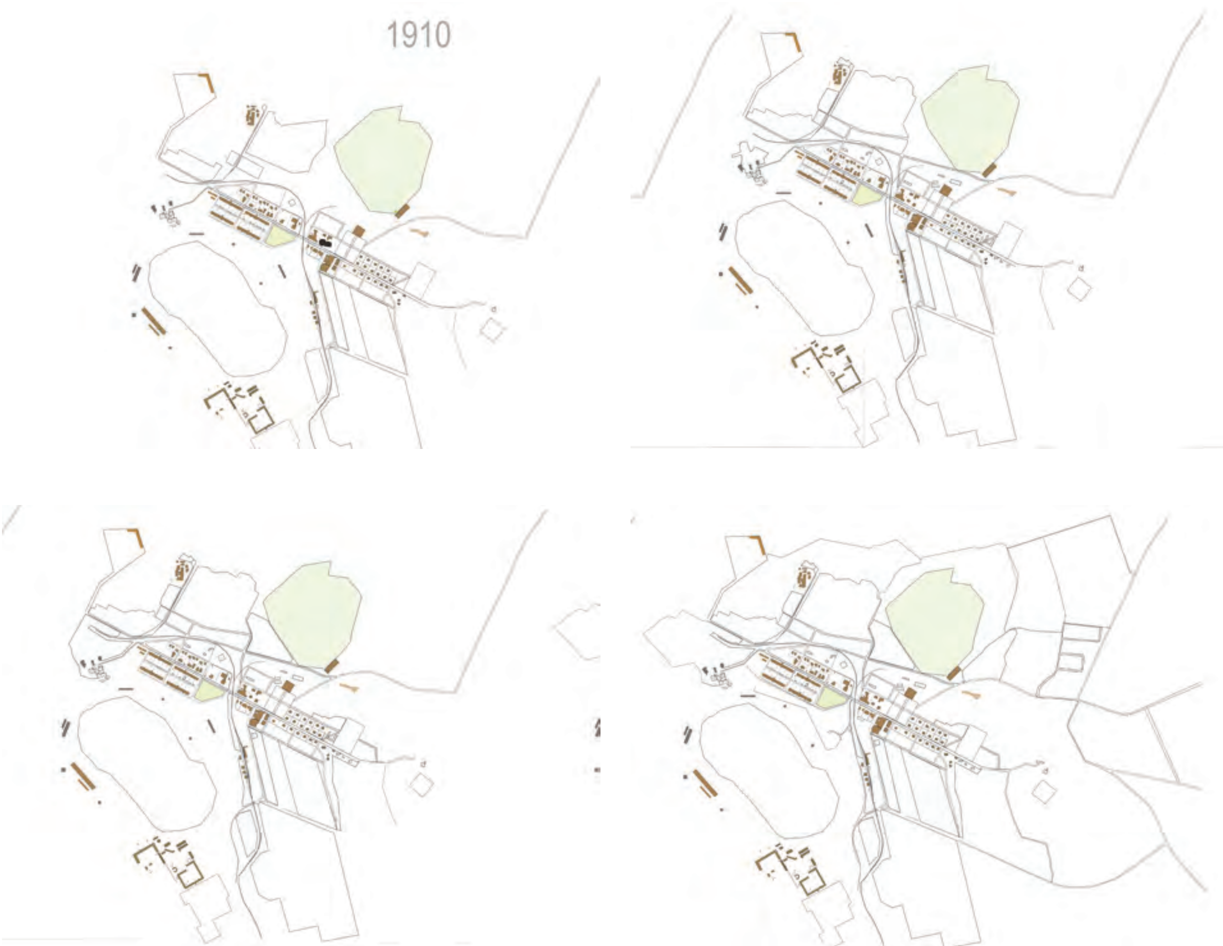


Figure 2.16. The growth of Cullinan part 2 (1910 onwards)
(Cullinan study group 2014).

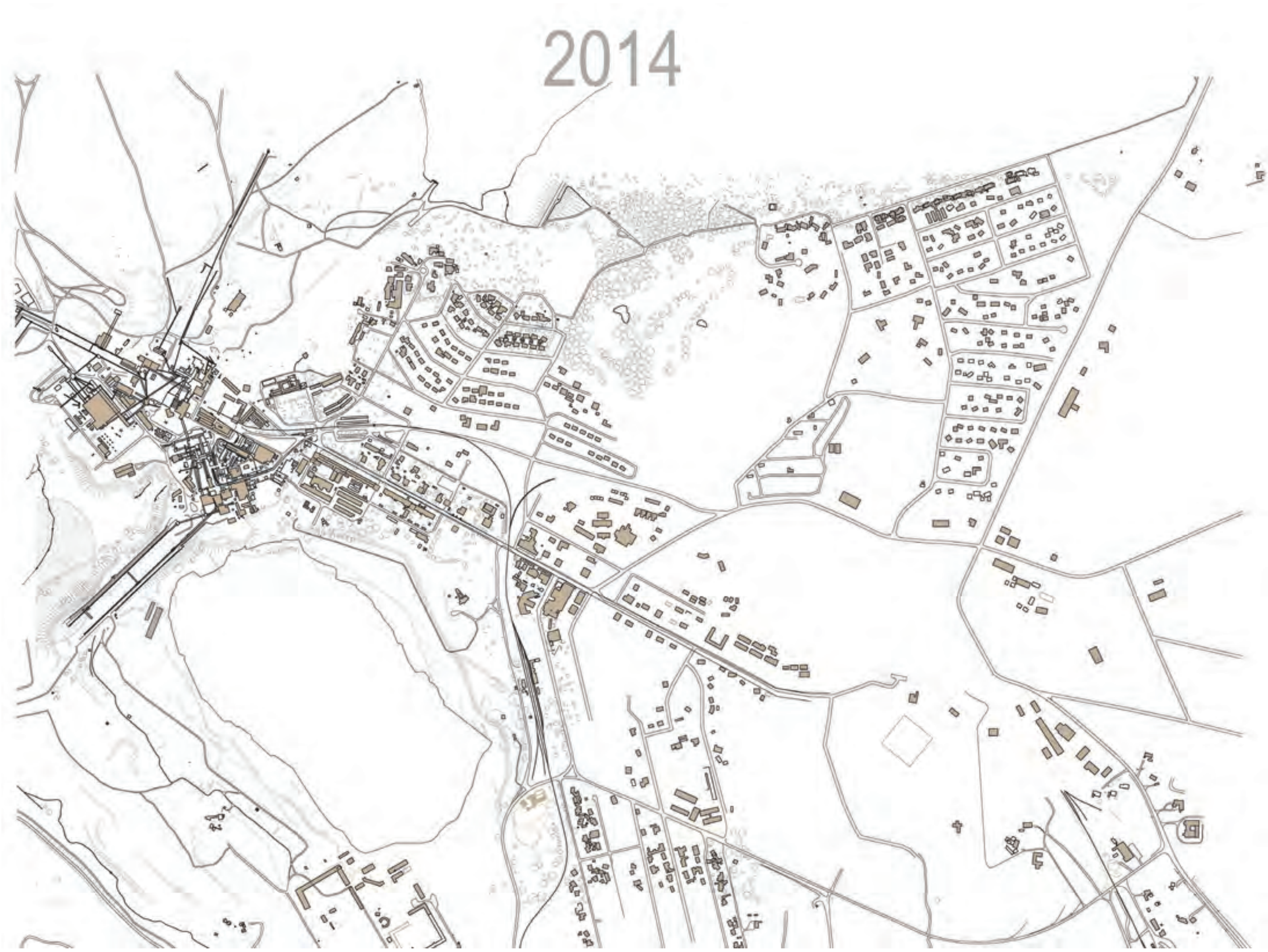


Figure 2.17. Cullinan today (Cullinan study group 2014)>

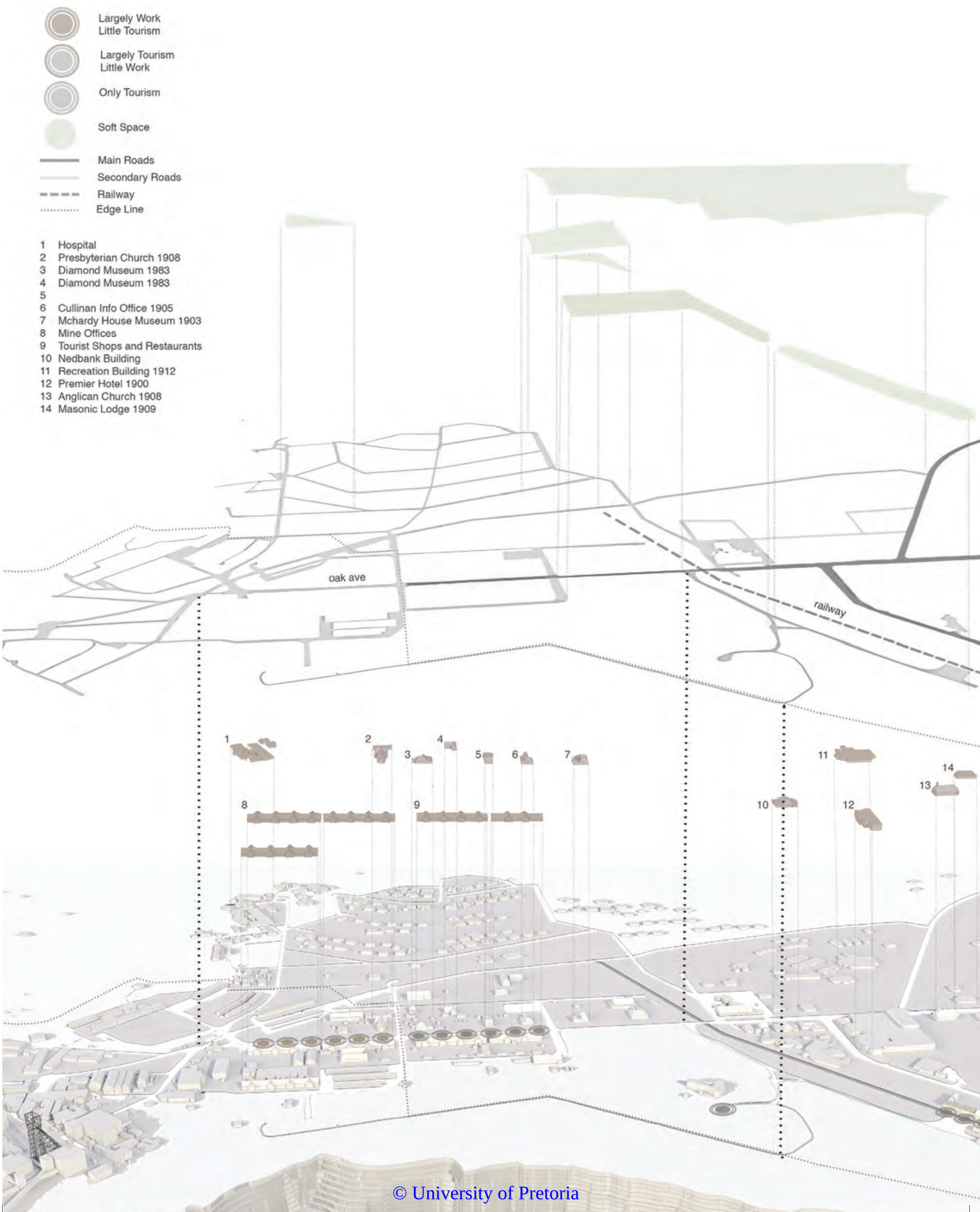
2.3 Mapping

In order to generate an urban vision, it was necessary to map the physical and less tangible aspects of the study area. The following diagrams and figures focus on the physical aspects of the town and the mine (Figures 2.18 and 2.19). The streets, railway line, significant heritage structures, spaces focussed on tourism (the only other livelihood of the town) and workplaces of the residents are shown.

The vegetation of the area is shown in Figure 2.20 and 2.21. Figure 2.20 shows the indigenous forbs, grasses and trees (obtained from Shangoni 2012: 56-91). It is important to note that some trees were planted alongside certain streets by the mineworkers on Sundays to keep them occupied. These streets now derive their names from the trees that were planted there (Figure 2.21) and although some of these species are not indigenous, they are important because of their heritage value. Figure 2.21 also shows the different programmatic zones in the town.

A photographic study was also done in different parts of the town to highlight textures and atmospheres of these parts of Cullinan (Figures 2.22 – 2.25). Another aspect that influences the atmosphere in the spaces of the town is the activity of people in them. The images depicted in Figure 2.26 aim to capture the activity in Oak Avenue during weekends and week-days.

Figure 2.18. (opposite) Elements of the town (Cullinan study group 2014).


Largely Work
Little Tourism
Largely Tourism
Little Work
Only Tourism
Soft Space
Main Roads
Secondary Roads
Railway
Edge Line
1 Hospital
2 Presbyterian Church 1908
3 Diamond Museum 1983
4 Diamond Museum 1983
5
6 Cullinan Info Office 1905
7 Mchardy House Museum 1903
8 Mine Offices
9 Tourist Shops and Restaurants
10 Nedbank Building
11 Recreation Building 1912
12 Premier Hotel 1900
13 Anglican Church 1908
14 Masonic Lodge 1909
oak ave
railway
1
2
3
4
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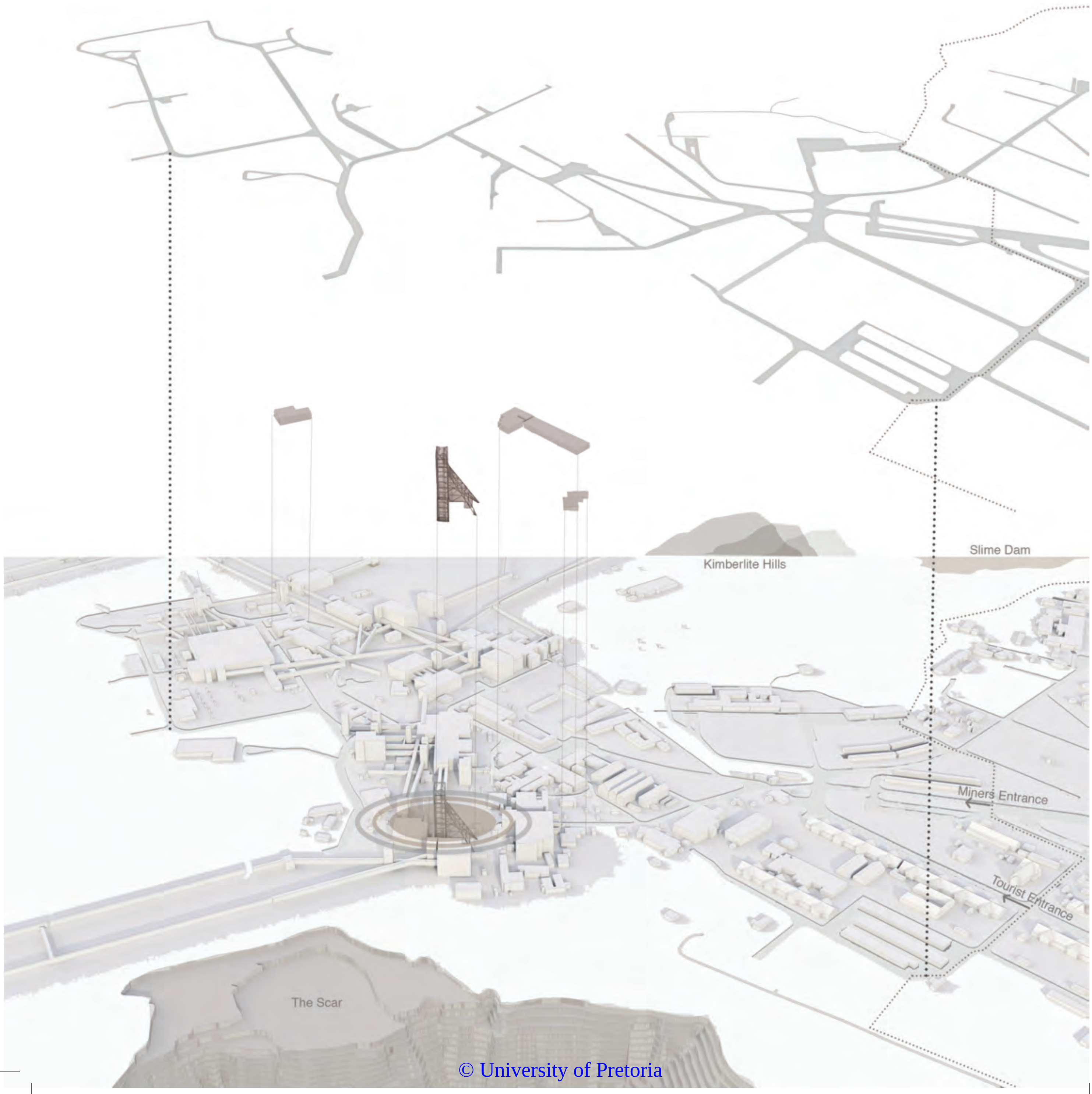

Kimberlite Hills
Slime Dam
Miners Entrance
Tourist Entrance
The Scar

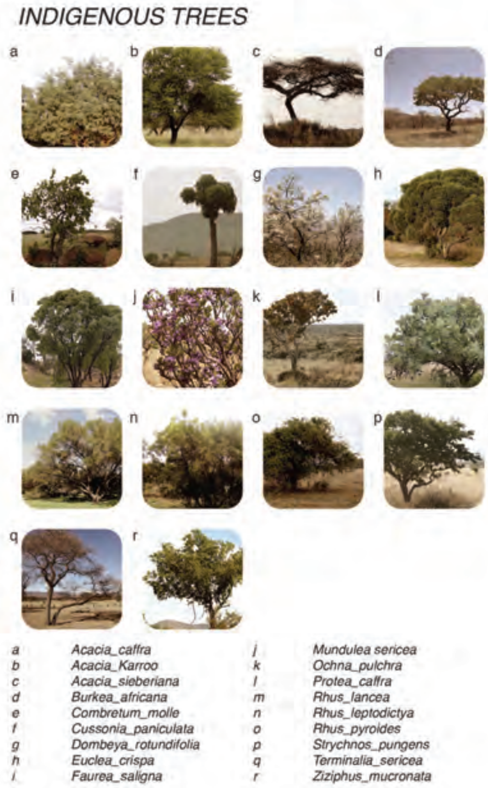
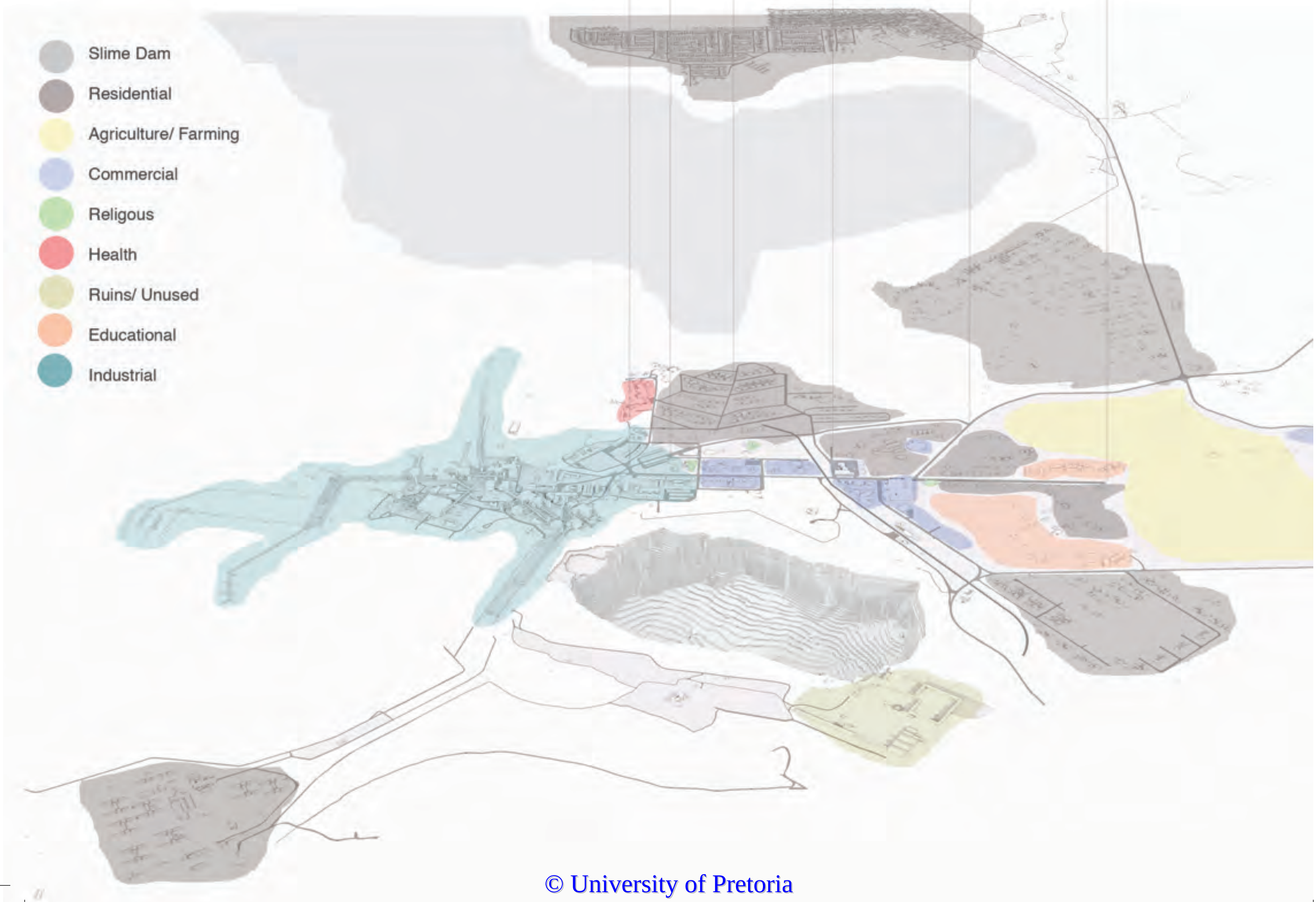


Figure 2.19. (opposite) The elements of the mine (Cullinan study group 2014).

Figure 2.20. Vegetation in the study area (Cullinan study group 2014)..

STREET NAMES

1 Oak Street- (Quercus suber)
2 Kameeldoring Street-(Acacia_erioloba)
3 Suikerbos Street- (Protea cynaroides)
4 Seringa Street- (Melia azedarach)
5 Olienhout Street- (Olea eurpaea Africana)
6 Protea Street-
7 Mimosa Street - (Acacia dealbata)
8 Jasmine Street-
9 Paperbark Street- (Acacia sieberiana)
10 Jacaranda Street- (Jacaranda_mimosifolia)
11 Bluegum Street- (Eucalyptus globulus)
12 Willow Street- (Salix babylonica)
13 Baobab Street- (Adansonia digitata)
14 Pine Street- (Pinus Patula)
15 Poplar Street- (Populus canescens)



COMPOUND

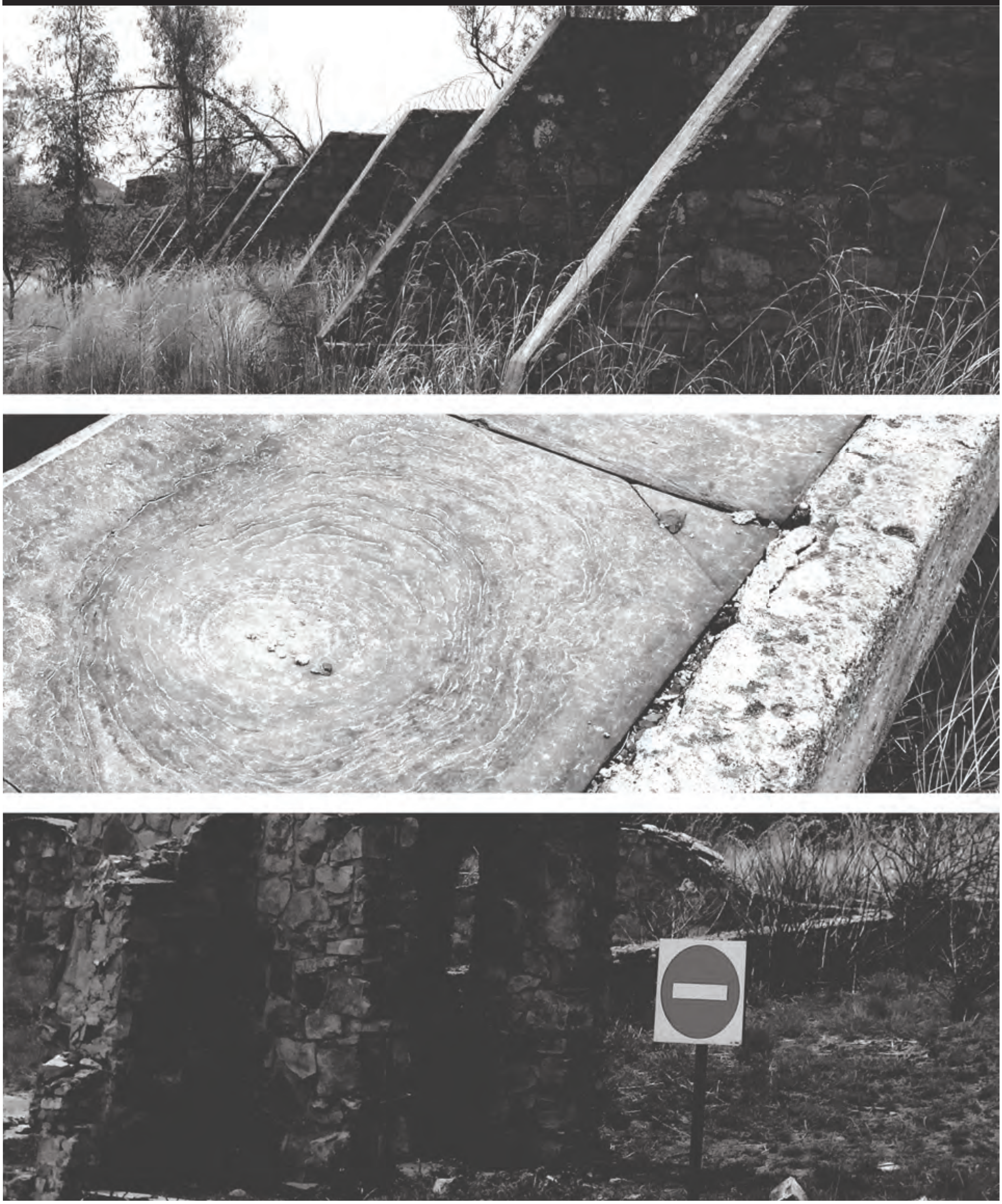


Figure 2.21. (opposite) Town programmatic zones and street names (Cullinan study group 2014).

Figure 2.22. Photographic study at compound (Cullinan study group 2014).

LOOK OUT

Figure 2.23. Photographic study at the lookout over the open pit (Cullinan study group 2014).

MINE

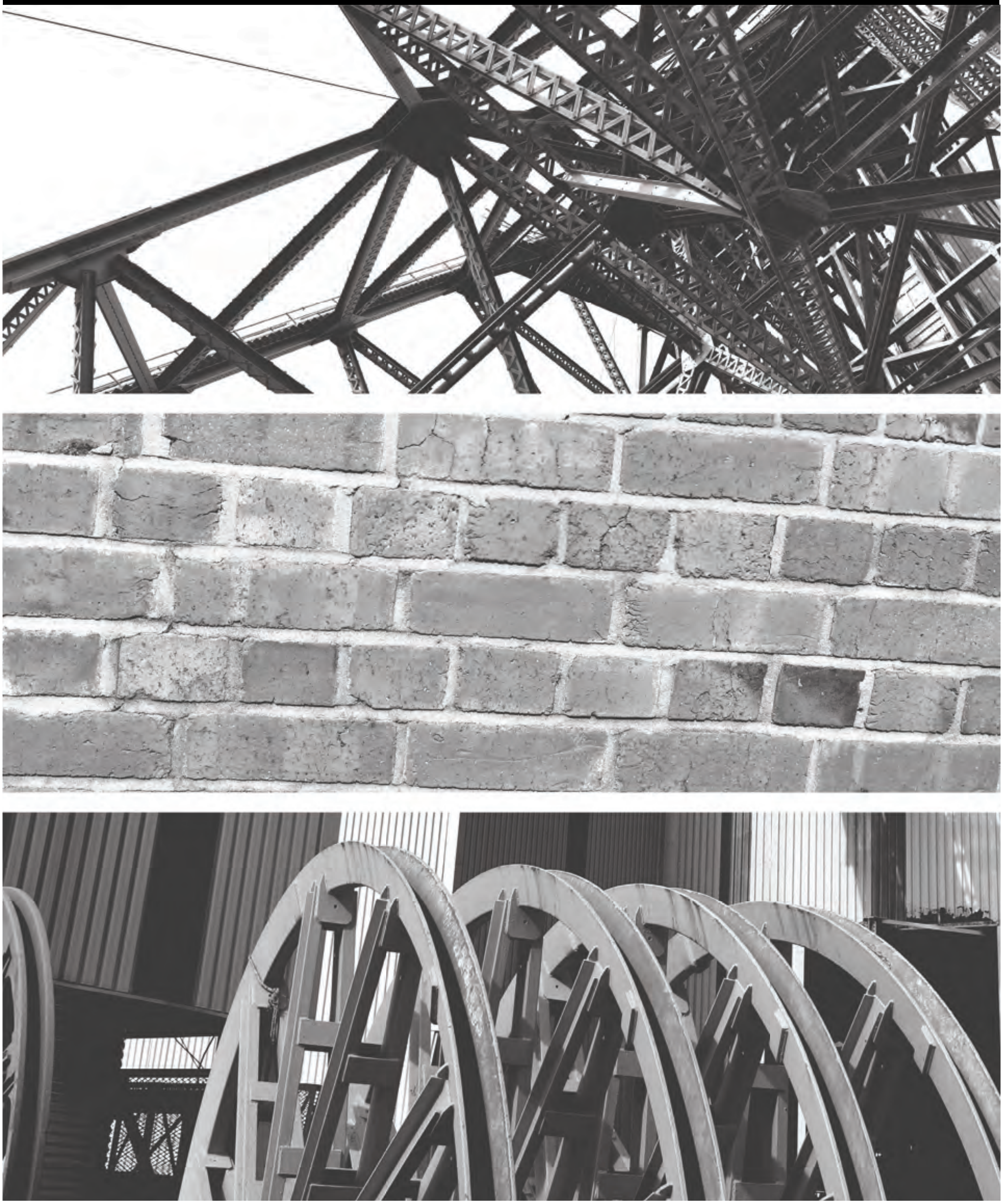


Figure 2.24. Photographic study at the working mine (Cullinan study group 2014).

TOWN

Figure 2.25. Photographic study of the town (Cullinan study group 2014).

Figure 2.26. Activity in Oak Avenue (Cullinan study group 2014).

Because some members of the group had proposals focussing on interaction between landscape and built form, a study was done in some areas within the town to depict the visual impacts of natural and man-made forms (Figures 2.27 – 2.30). Forms in spaces are exaggerated and used to depict the experiential impact on these spaces of both natural and built landscape. The impact on the experience of the space is a subjective measurement of textural contrast, smell, taste and perceived scale. The scale of the forms in the new composition is directly equivalent to the scale of the impact of experience of the built and natural objects.

Figure 2.27. (top right) Form study next to railway station (Cullinan study group 2014).

Figure 2.28. (spread) Form study at ventilation shaft (Cullinan study group 2014).

Man Made Natural

Man Made Natural

Figure 2.30. (top) Form study at lookout point (Cullinan study group 2014).

Figure 2.29. (bottom) Form study in town center (Cullinan study group 2014).

Chapter 3
A guide to subverting the machine: The urban vision.

"He has a mind of metal and wheels and he does not care for growing things, except as far as they serve him for the moment."(Tolkien 1955: Chapter 4, 40 minutes into recording).

The previous chapter presented the mapping exercises and results that the Cullinan study group obtained from them. Research was also done into the history of the town, its people and the mine, and how their interaction influenced the growth of the town. This chapter will present how the group used this research and mapping information to generate an urban vision for the town of Cullinan. This urban vision was designed for when after the mine is decommissioned in about twenty years from now.

The last part of this chapter will focus on the study area around the No.1 shaft in the mine and the urban framework developed for this area by Walter Raubenheimer and Marcel Mattheüs. The surrounding buildings are examined and the two sites for architectural intervention are introduced therafter.

Figure 3.1. The machine and the town (aerial photograph by Petra Diamonds 2012).

3.1 Statement of significance

Before the development of the urban vision it was important to identify the heritage significance of various aspects of the town, landscape and mine. A statement of significance was generated in accordance with the Burra Charter (Australia ICOMOS Charter for places of cultural significance 1999: 10). Both the UNESCO recommendation on the Historic Urban Landscape (2011) and the ICOMOS – TICCIH principles for the conservation of industrial heritage sites, structures, areas and landscapes (2011) were also consulted in the generation of the statement of significance. The UNESCO recommendation, because the town could be considered a historic urban landscape, and the TICCIH charter as the mine contains many structures and processes that could be considered industrial heritage. This statement was referred to during the development of the urban vision. The statement of significance that was generated follows:

3.1.1 Importance of site.

Cullinan has technological, associative, natural, cultural, historical, aesthetic and architectural value.

The hierarchy of heritage resources in accordance with value and significance is:

1. The open pit speaks of Cullinan's unique character/identity. The open pit represents man's impact on and relationship with the environment. It also denotes man's technological progression and development.
2. The mine is what shaped the character of place, serving as a catalyst for the development of the town
3. Oak Avenue signifies the unique character of the town and the original village development.

3.1.2 What Cullinan represents.

Cullinan represents a unique narrative embedded in place and an important South African history. It represents the narrative of diamond mining in the context of the Highveld and the event of the discovery of the largest diamond in the world. It signifies the stories of the villagers who lived in Cullinan and worked in the mine. Cullinan also represents the dependent relationship between man and the environment. Cullinan is important to all South Africans as it speaks of our history.

3.1.3 What needs to be done.

The value of Cullinan needs to be shared. Its value and meaning should be exposed to society and the sense of place retained after the future context of mine closure. The unique narrative of the existing town, context and mine needs to be respected and preserved. The heritage resources of significant value need to be protected. The historic urban landscape needs to retain the characteristics and values linked to its history and collective memory (UNESCO 2011: 7). Uncontrolled development may negatively impact the character of the town (UNESCO 2011: 5). The existing urban fabric is to be respected in the future possible development and within the proposed urban vision.

Figure 3.2. The open pit (Cullinan study group 2014).

Figure 3.3. Oak Avenue (Cullinan study group 2014).

3.1.4 What can be done.

The Urban intervention can be respectful and responsive to the unique and existing patterns that shape Cullinan. Sustainable development within the context will ensure the preservation of the existing resources (UNESCO 2011: 5). The heritage of the town has potential to serve as a resource.

3.1.5 What we intend to do.

Investigate resilient and sustainable ways of generating resources for the town. Investigating new uses for heritage resources as assets and sources of revenue.

3.2 Response to the current singular industry and resilience.

Currently the town is mainly supported by the diamond mine, with tourism being a secondary income source. In its current state, the tourism industry of Cullinan will not be able to support the town if the mine is decommissioned. Proposals for the tourism industry of the town to be strengthened to become the town's main income source presents us with the same problem that exists now. Even if tourism can become a viable resource for the towns survival, the town will still be in danger if the tourism industry fails, a similar scenario as the mine closure.

We therefore considered resilience theory. The solution for this problem is a multi-scalar network of craft industries, educational facilities, tourist attractions and agricultural resources. This network will then support the town and doesn't just rely on one industry on one scale, as the mine did. If one of these nodes in the network fail, the other would continue to support the town due to the diversity of their programs at varying scales. This will ensure a more resilient support system (Ernstson, van der Leeuw, Redman, Meffert, Davis, Alfsen & Elmqvist 2010: 532-537).

3.3 Urban vision, intentions and proposal.

The above theories and statement of significance was then synthesised into a proposal and urban vision for Cullinan summarised in Figure 3.4 to 3.5 and Figure 3.7 to 3.11.

Figure 3.4. Intentions for the urban vision (Cullinan study group 2014).

> We delimit ourselves to the context of post-operational mine closure and intend to establish 'A Guide to Subverting the Machine'.

> Address the loss the mine as a key economic sector and main source of local income generation

> Investigate the concepts of resilience and regeneration

> Reintroduce craftsmanship in response the industrial context. Transfer skills and knowledge, thereby uplifting the local community in order to ensure future economic development.

> Establishing connection between the tangible and intangible ecological components on the site and ensure the protection of important cultural and industrial heritage.

> To ddress disturbed ecological system

> Address the fragmentation of the existing town, mine and landscape

> Cullinan is significant for its heritage tourism, as a dormitory town and a weekend getaway for residents of Gauteng's urban areas and as an agricultural hub and tourist node. This can serve as a new resilient means of income generation. The intention is to explore these possibilities

INTENTIONS

AGRICULTURE  1	> Cullinan should become the core of the larger regional agricultural hub and a new agricultural strip should be introduced around the big hole to support new local micro-industries related to agriculture
TOURISM and HERITAGE  2	> The vision will expose the heritage value of Cullinan to society and use it as a source of revenue and support for the community > Tourists will become a market for produced commodities > The large open pit should be retained as is after mine closure as it is an important part of Cullinan's narrative and also a major tourist attraction. The impact of the instability of the hole is recognized. A new 'agricultural route' for tourists is established around the hole marking the 100 year breakline of the hole. Existing mine pumps used to currently dewater the hole will be used to remove water from the hole, when necessary, to support surrounding agriculture
LIGHT INDUSTRY  3	> Support those who have been trained in the community > Generate new income and resources in a resilient manner > In Cullinan, there potential to reuse old industrial buildings for new forms of production
ECOLOGICAL  4	> The scarred landscape consisting of mine dumps in the form of kimberlite trailing's and the slime dam needs to be rehabilitated in order to prevent its negative effect on the ecology and industries (such as tourism and agriculture). > The plant species used for rehabilitation and remediation must not be invasive and must be able to establish a new habitat for endemic species and endangered species like the Rand Highveld Grassland vegetation type.
EDUCATION  5	> Support and educate the unemployed community and Refilwe > Resilience is created through complexity of activities THE VISION

Figure 3.5. (opposite) The urban vision (Cullinan study group 2014).

Figure 3.6. (above) View of the open pit, mine and kimberlite tailings reservoir (Cullinan study group 2014).

The interconnected relationship that once existed between the town, the mine and the landscape has been lost. In response to this the proposed urban framework will investigate how the existing fragmented components and areas within Cullinan namely:

- The Historical Compounds
- The Railway station
- The Ventilation shaft
- The Cullinary node
- The area within the mine surrounding the No. 1 Shaft and Headgear

can be stitched together to establish an interconnected relationship between them. This will be achieved by means of a new primary spatial structure that is proposed as a circular route around the open pit, which connects the various areas to each other but also becomes a scenic circle route for visitors to Cullinan as shown in Figure 3.7.

Along this primary spatial structure a series of public squares are established at crucial points, creating social, economic and cultural opportunities. The surrounding commercial, public and cultural ventures feed into these public squares and draw energy and potential from them.

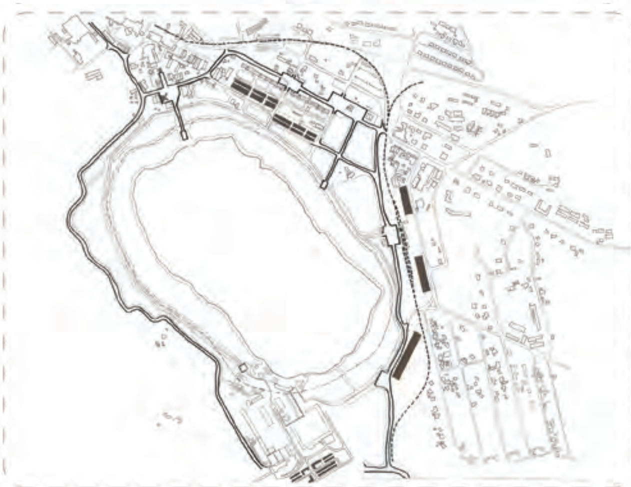


Figure 3.7. (top) Newly proposed primary and seconary route structures (Cullinan study group 2014).

Figure 3.8. (bottom) Newly proposed development in town (Cullinan study group 2014).

These public squares are located within a 5 min walking distance from one another allowing them to be connected by means of pedestrian circulation routes. The wide sidewalk currently existing along Oak Avenue, is extended to connect with the new public square proposed within the mine.

From this primary spatial structure the secondary spatial structure branches off towards the open pit excavation, establishing new connections to the historical fabric of the mine, the town and various viewpoints around the edge of the excavation.

New visitors accommodation units are proposed along the edge of the excavation to allow for a view towards the open pit on one side, while spilling out into public green space on the other side contained by the historical fabric of the town on its northern edge. This allows for a visual connection with the excavation while maintaining a public interface along Oak Avenue.

A productive agricultural belt is established around the western edge of the excavation to provide the local community with agricultural opportunities, remediate the scarred landscape by transforming it into a productive landscape and to provide raw material to the new proposed industries.

Figure 3.9. (top) Proposed green structure (Cullinan study group 2014).

Figure 3.10. (bottom) Site allocations for study areas (Cullinan study group 2014).


orchards
orchards
STUDY AREA: MINE
Walter Raubenheimer
Marcel Mattheus
vetiver /
grain crops
parks
STUDY AREA: CULLINAN TOWN
& VENT SHAFT
Nikita Edwards
natural
landscape
orchards
productive
vegetation
Hemp production
Hemp production
STUDY AREA: COMPOUND
Paige du Toit
Natasha Laurent
Hugo van Niekerk (Landscape Architecture)

Figure 3.11. The proposed urban vision (Cullinan study group 2014).

3.4 Study area: Mine.

The following is a more detailed framework developed by Walter Raubenheimer and Marcel Mattheüs for the proposed public square and surrounds at the No.1 shaft in the mine.

3.4.1 Current buildings, their uses and significance

It was necessary to analyse the existing buildings in the mine area around the No.1 headgear and shaft in order to ensure that their heritage value would not be lost in the new proposal. This recording of value was done in accordance with the TICCIH principles of 2011 (ICOMOS 2011: 3). It is important to understand what is considered the values of industrial heritage according to these principles. These values are as follow (ICOMOS 2003: 1-2):

• The industrial heritage is the evidence of activities which had and continue to have profound historical consequences. The motives for protecting the industrial heritage are based on the universal value of this evidence, rather than on the singularity of unique sites.

• The industrial heritage is of social value as part of the record of the lives of ordinary men and women, and as such it provides an important sense of identity. It is of technological and scientific value in the history of manufacturing, engineering, construction, and it may have considerable aesthetic value for the quality of its architecture, design or planning.
• These values are intrinsic to the site itself, its fabric, components, machinery and setting, in the industrial landscape, in written documentation, and also in the intangible records of industry contained in human memories and customs.

Figure 3.12. Kimberlite tailings (Walter raubenheimer 2014).

• Rarity, in terms of the survival of particular processes, site typologies or landscapes, adds particular value and should be carefully assessed.

The value of the buildings within the study area had to be recorded, not only in terms of the structure and historical value, but also in terms of their housed process and machinery. Most of the buildings in the study area were built to house a singular function within the mining process. These buildings have been documented and are shown in Figures 3.13 to 3.22. The different values ascribed to these structures and buildings were defined according to the above as follows:

Historical value: The building or structure represents historical consequences in the town and its development.
Functional value: The building or structure houses a function that is crucial within the process of the diamond mine, and therefore carries value.
Social value: The building or structure represents a function that had impact on the daily lives of the townspeople who worked in the mine.
Architectural value: The building or structure is architecturally unique in the town or is a very good example of a type of architecture found in the town.
Technological value: The technology housed within or used in the construction of the building or structure is rare or unique.
Only the buildings of significant value in the precinct are listed in Figures 3.13 to 3.22. Newer buildings and structures, or buildings and structures that have many similar examples in the precinct are not documented and do not carry enough significance to merit preservation within the urban framework.

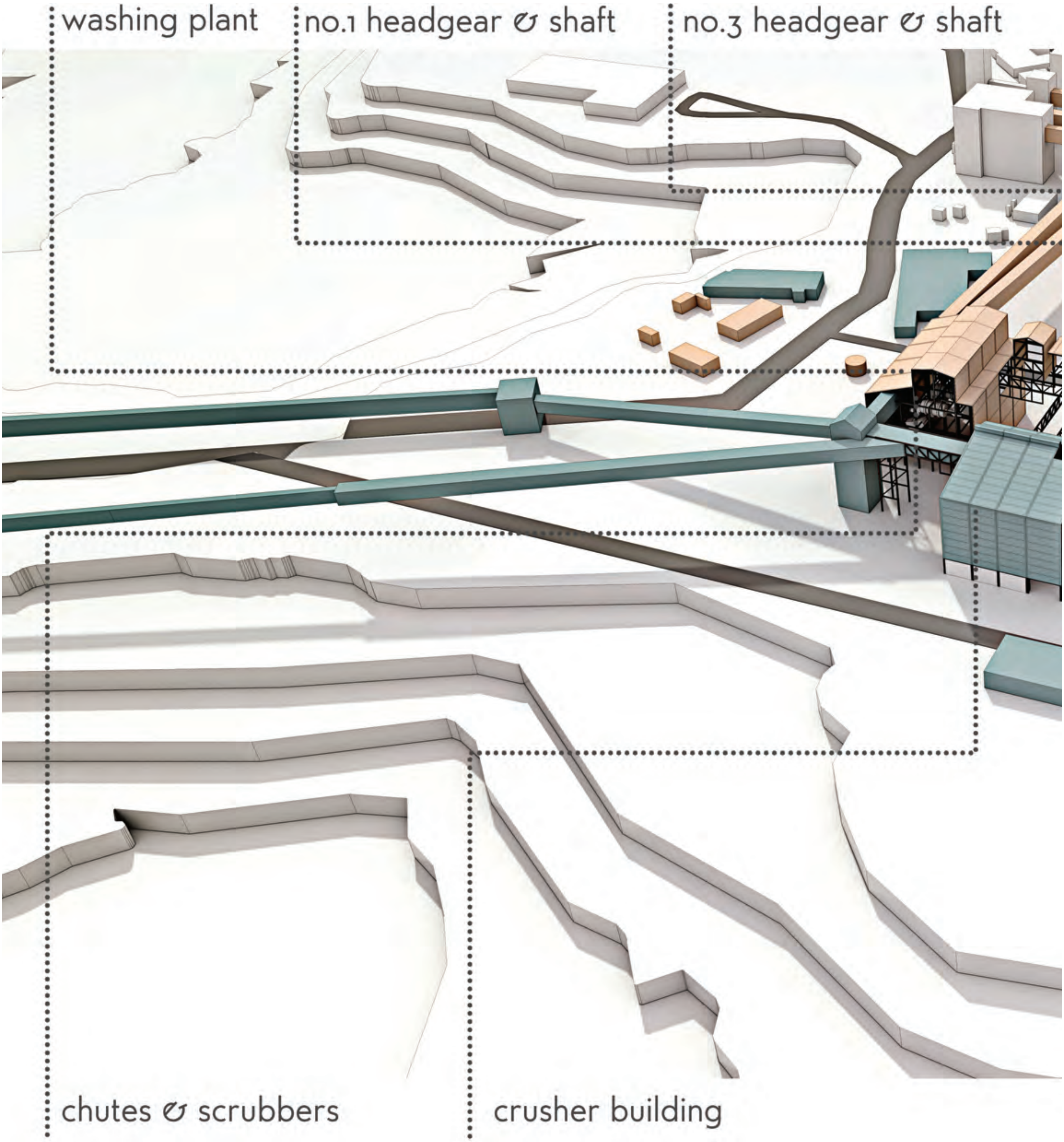
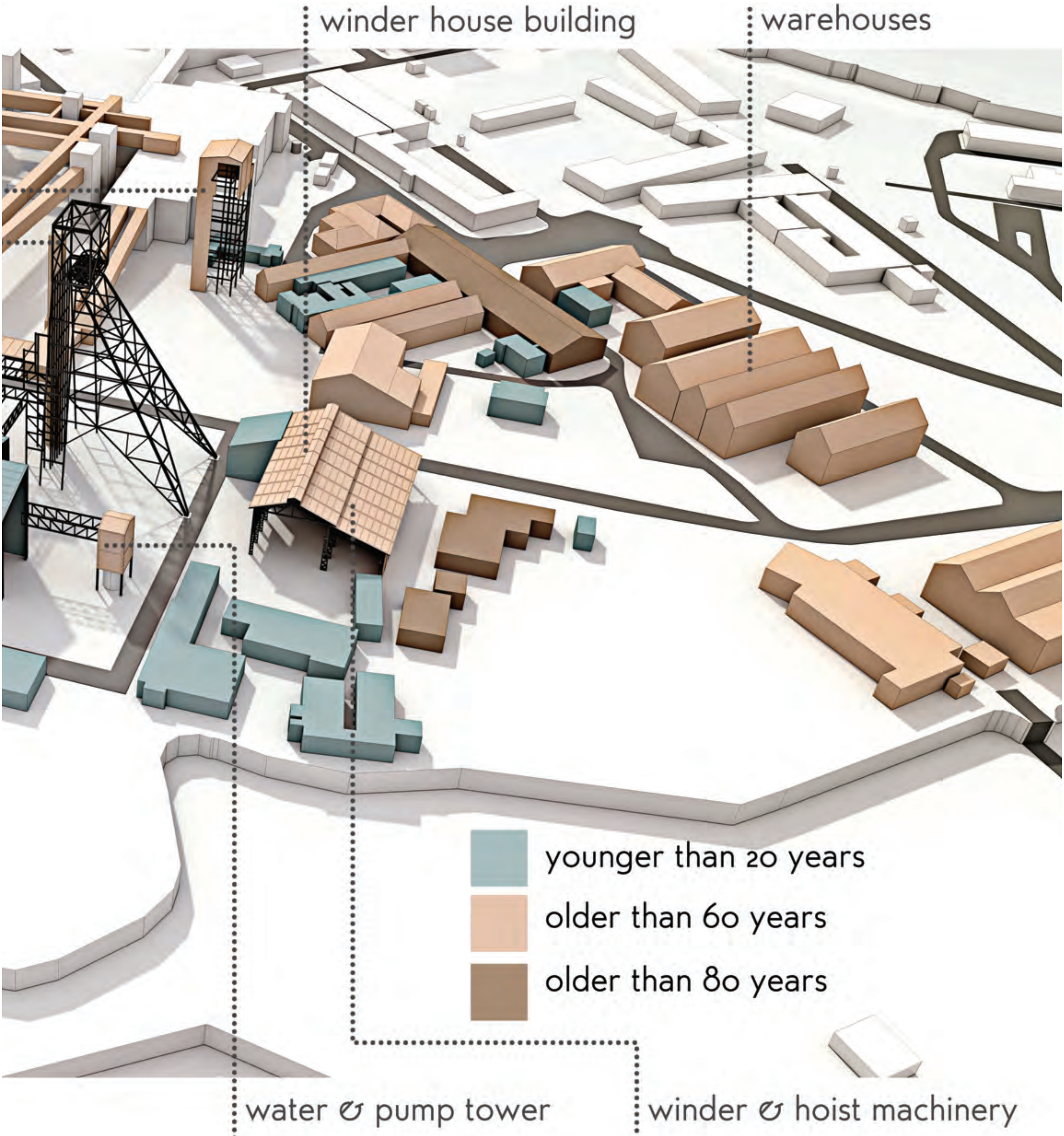


Figure 3.13. The study area around the No.1 shaft and headgear (Walter Raubenheimer & Marcel Mattheüs 2014).


winder house building
warehouses
younger than 20 years
older than 60 years
older than 80 years
water & pump tower
winder & hoist machinery

Washing plant (Figure 3.14)

Value: Functional value; Historical value
Age: Older than 60 years.
Condition: Good condition. Metal sheet cladding on Northern and Western facades needs to be replaced. Some metal roof sheets need replacement. Structure is sound.

No.1 headgear and shaft (Figure 3.15)

Value: Historical value; Functional value; Architectural value; Technological value, the first structure in South Africa to be completely assembled with only bolt and rivet joints (Petra Diamonds 2014).
Age: Older than 60 years.
Condition: Very good, steel joints and members require minor maintenance.

No.3 headgear and shaft (Figure 3.16)

Value: Social value; Functional value; Architectural value
Age: Younger than 20 years.
Condition: Very good, steel joints and members require minor maintenance.

Winder house building (Figure 3.17)

Value: Functional value; historical value
Age: Older than 60 years.
Condition: Good condition. Some metal roof sheets need replacement. Structure is sound.

Figure 3.14. (top left) Washing plant (Author 2014).

Figure 3.16. (bottom left) No.3 headgear and shaft (Author 2014).

Figure 3.17. (top right) Winding house building (Author 2014).

Figure 3.15. (bottom right) No.1 headgear and shaft (Author 2014).

Historical warehouses (Figure 3.18)

Value: Historical value; Architectural value
Age: Older than 80 years.
Condition: Fair condition. All metal sheets need replacement. Structure requires some maintenance.

Chutes and scrubbers (Figure 3.19)

Value: Functional value. All four units need to be preserved as the washing plant was a structure that was built to support all four and the building loses its functional value if any are removed.
Age: Older than 60 years.
Condition: Very good condition.

Water pump and tower (Figure 3.21)

Value: Functional value
Age: Older than 60 years.
Condition: Good condition. Structure and cladding in sound condition.

Crusher building (Figure 3.20)

Value: Functional value
Age: Younger than 20 years
Condition: Good condition. Some metal roof sheets need replacement. Structure is sound.

Winder and hoist machinery (Figure 3.22)

Value: Functional value. A single unit of each needs to be conserved by means of preservation.
Age: Older than 60 years.
Condition: Good condition. Requires some maintenance.

Figure 3.18. (below) Historical warehouses (Author 2014).

Figure 3.19. (top left) Chutes and scrubbers (Author 2014).

Figure 3.20. (top right) Crusher building (Author 2014).

Figure 3.22. (bottom left) Winding machinery (Author 2014).

Figure 3.21. (bottom right) Water pump and tower (Author 2014).

3.4.2 Urban vision for the precinct.

It has already been said that the one of the main intentions of the new urban vision for the town of Cullinan is to create a resilient network of industries for the town after the closure of the mine. The three study areas will focus on agriculture, craft industry, tourism and education. Within the larger framework the area within the mine was envisioned to become a production node (Figure 3.11), which will also include a public interface.

By doing so this node will respond to the industrial heritage by means of a new productive program (craft industry). The public interface will ensure a means of enforcing the tourism of Cullinan. This productive node will also need raw materials and craftsmen and women, and thereby will link into the agriculture and education proposed.

After consideration of the heritage value of the mine after its closure, it became apparent that focus should be given to the current functions of the buildings and structures. The processes also had a direct social narrative in the fact that workers entered the underground tunnel system through the No.3 shaft and headgear and resources (Kimberlite ore) surfaced at the No.1 headgear and shaft.

Responding to this narrative it is proposed that the No.1 and No.3 headgear structures become circulation beacons (Figure 3.24). The precinct is to be linked to Oak Avenue (which has been widened) to the Southeast. The space between the winding house, washer plant and crusher building (the space underneath and surrounding the No.1 headgear) is to be sunken by three meters with public staircases and amphitheatres leading up to the surrounding buildings and their newly proposed public interface at current ground level (Figures 3.24 and 3.25). This sunken courtyard then passes underneath the extended Oak Avenue and ramps up to the No.3 headgear and shaft (Figures 3.23 and 3.25). A new green structure is also proposed next to this ramp (Figures 3.23 and 3.24). To the West of the No.3 headgear a new parking lot is proposed, as it is anticipated that most visitors will arrive by car (Figures 3.23 and 3.25).

This achieves an acknowledgement of the current narrative of people being sunken below ground level in order for resources to emerge in the precinct. This also uses the already existing industrial beacons as circulation beacons. The No.1 headgear is to become a vertical circulation shaft leading to a lookout point and upper levels of the surrounding buildings (Figures 3.25). The sunken public square also acts as a space of repose for visitors before being exposed to the vast scales and harsh nature of the surrounding buildings.

The current winder house becomes the main entry point for pedestrians from the rest of the framework (Figure 3.26). Here visitors will see the preserved hoisting machinery. It is proposed that this building also has to contain small stalls for the sale of goods produced within the new framework. The washing plant and crusher house will contain new functions that acknowledge the narrative of cleaning and crushing (these two buildings house both of these functions, but at different scales in the process) and are to be used in the designs of Walter Raubenheimer and Marcel Mattheüs respectively.

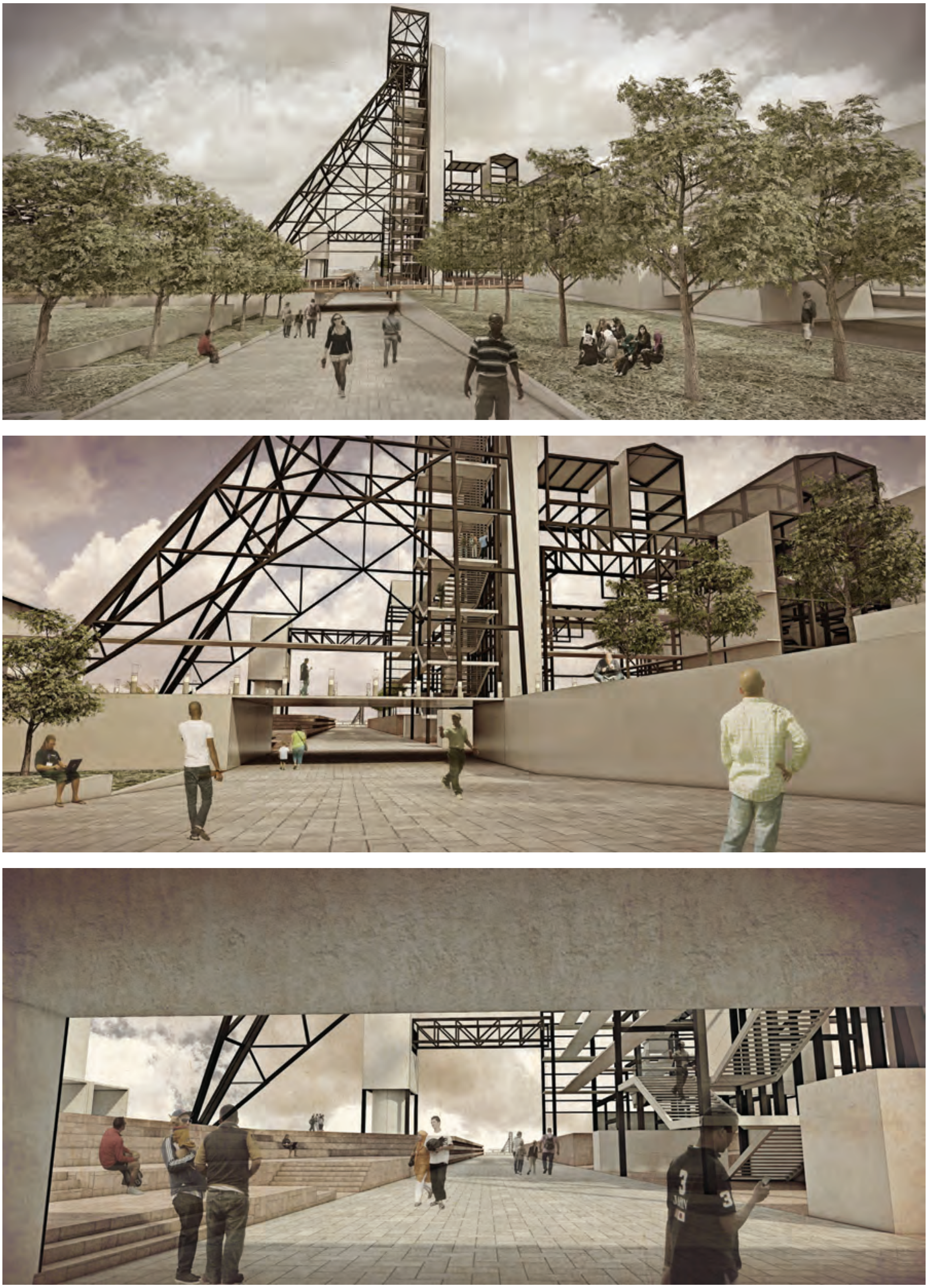
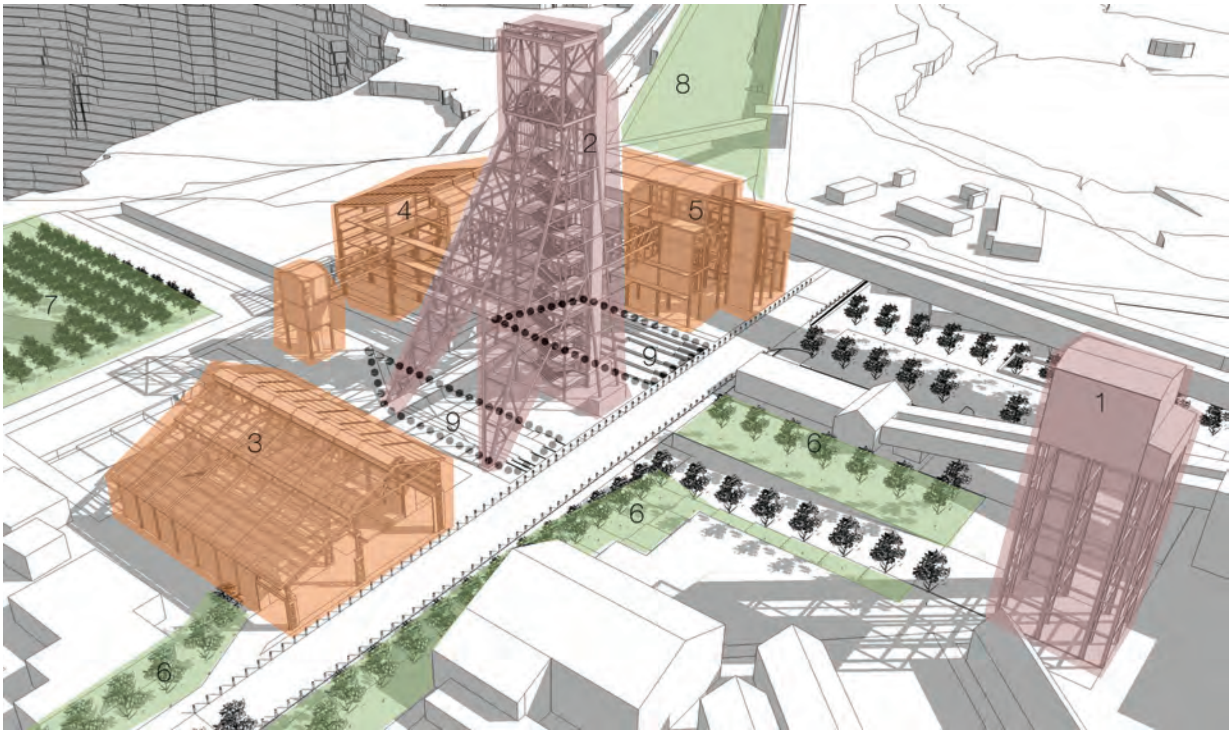


Figure 3.23. The sequence of arrival approaching from the No.3 headgear (arrival by car) (Walter Raubenheimer & Marcel Mattheüs 2014).



1. circulation beacon 2. industrial landmark and vertical circulation 3. entrance threshold, nursery and retail 4. vetiver washing plant 5. mill 6. green spaces 7. orchards 8. agriculture

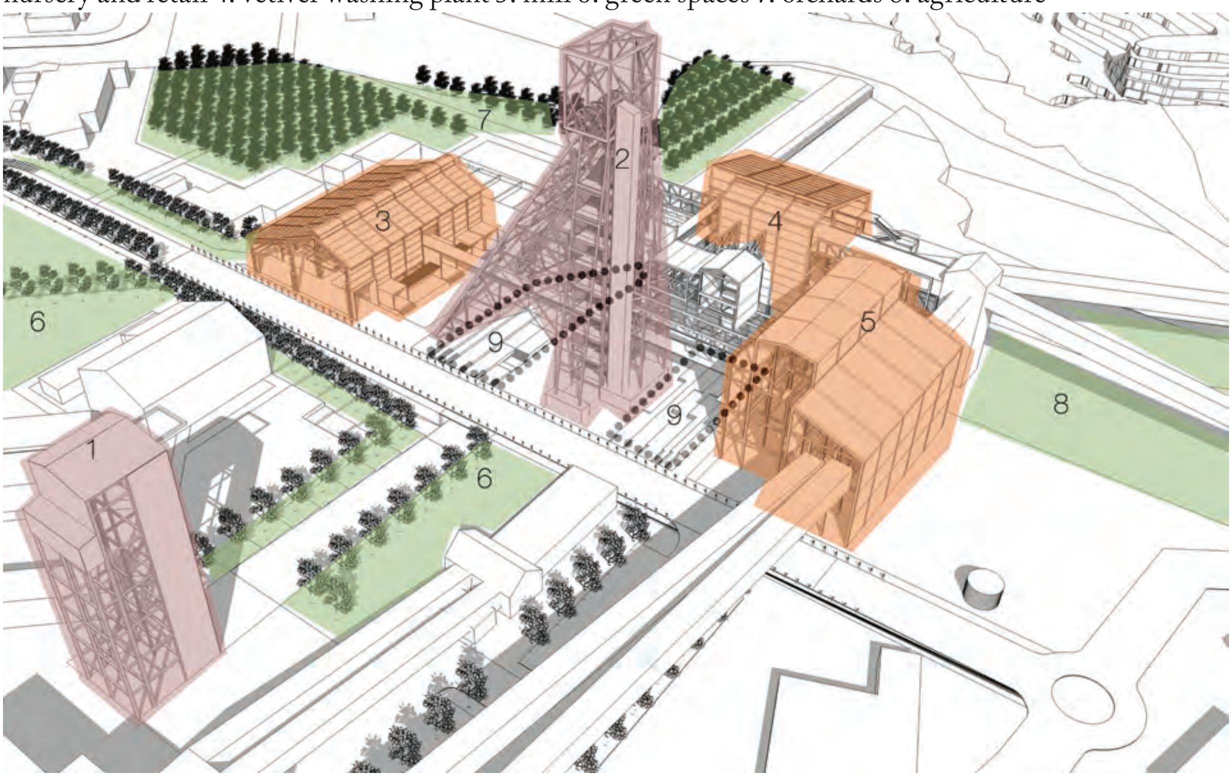
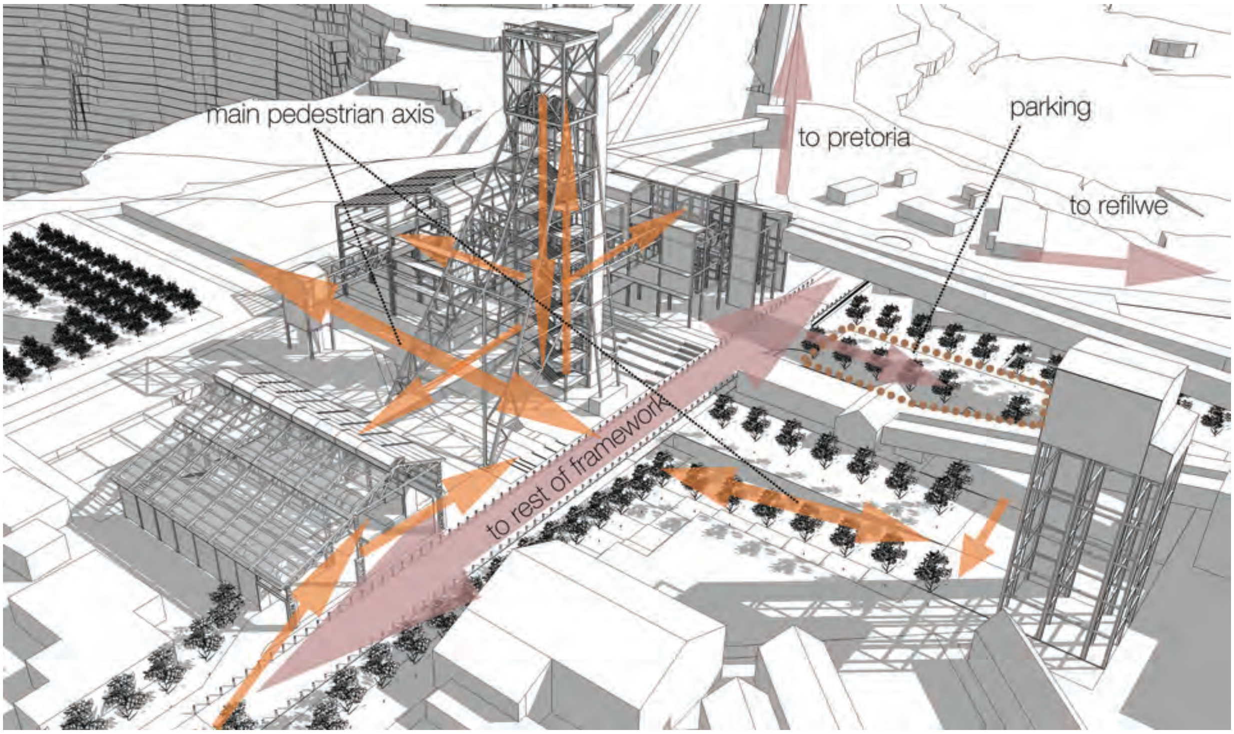


Figure 3.24. Views of precinct from the Northeast (top) and Northwest (bottom) showing proposed uses and new spaces (Walter Raubenheimer and Marcel Mattheüs 2014).



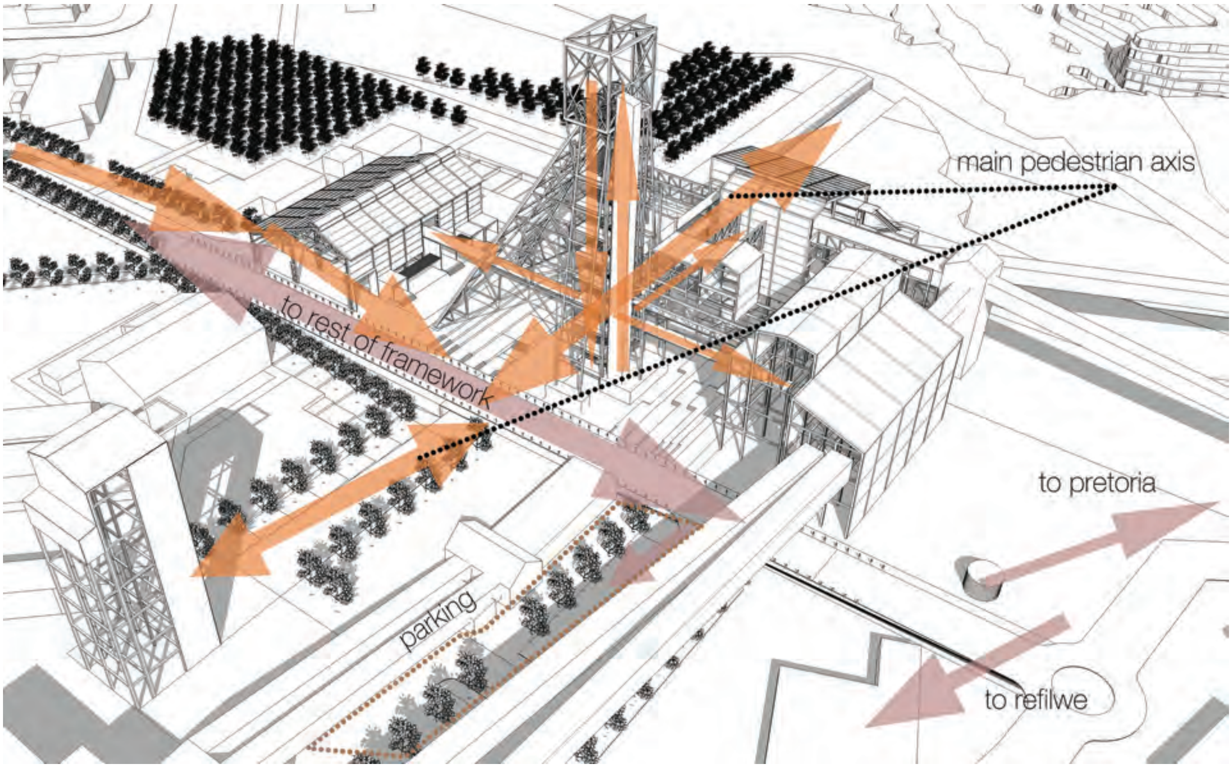


Figure 3.25. Views of precinct from the Northeast (top) and Northwest (bottom) showing movement and circulation (Walter Raubenheimer and Marcel Mattheüs 2014).

Figure 3.26. The sequence of arrival approaching from the Oak Avenue (arrival by foot) (Walter Raubenheimer & Marcel Mattheüs 2014).

3.4.3 Proposed sites and study area for dissertation

It has already been mentioned that the washing plant and crusher buildings would be used as part of new interventions in the precinct framework. Their new functions need to acknowledge their previous uses. Figure 3.27 shows the site allocation for the two new interventions. The area to the South and Southwest (site 1) of the water and pumping tower including the crusher building is the site to be used by Walter Raubenheimer. The washing plant building and the area to the South and the Kimberlite tailings reservoir (site 2) is the site to be used by Marcel Mattheüs (the author) as a site.

One of the previously mentioned (chapter 2) drawings that were obtained from Petra Diamonds (2014) shows the working drawings for the washer building, chutes and scrubbers (Figure 3.28). As can be seen, the building is part of a bespoke structure to support the four chutes and scrubbers. As such the functional value of the building would be lost if the structure is altered or one of the scrubbers is removed. The intervention therefore has to be sensitive to these two elements. Due to the scale of the building it would not be impossible to insert new functions into this building.

The information contained in this chapter has been used for the development of the design of a new intervention, which explores the relationship between architectural form and landscape, and how architectural form could be used as a link between the industrial heritage, the user and the landscape.

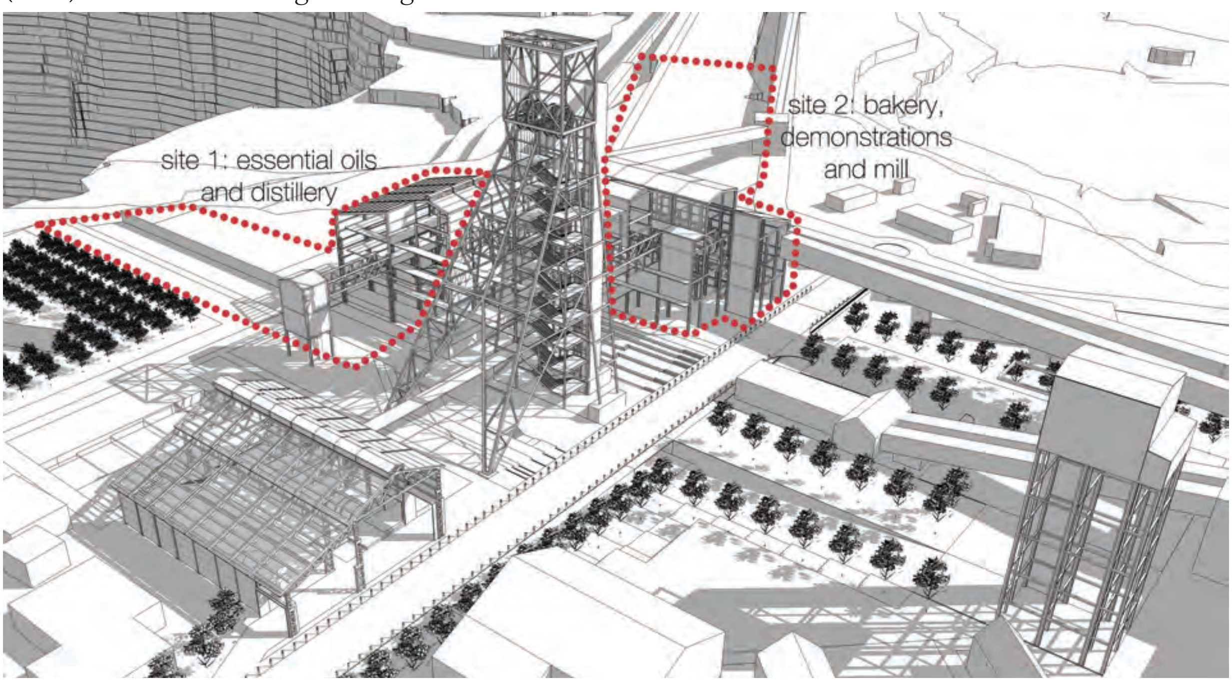


Figure 3.27. The proposed sites (Author 2014)

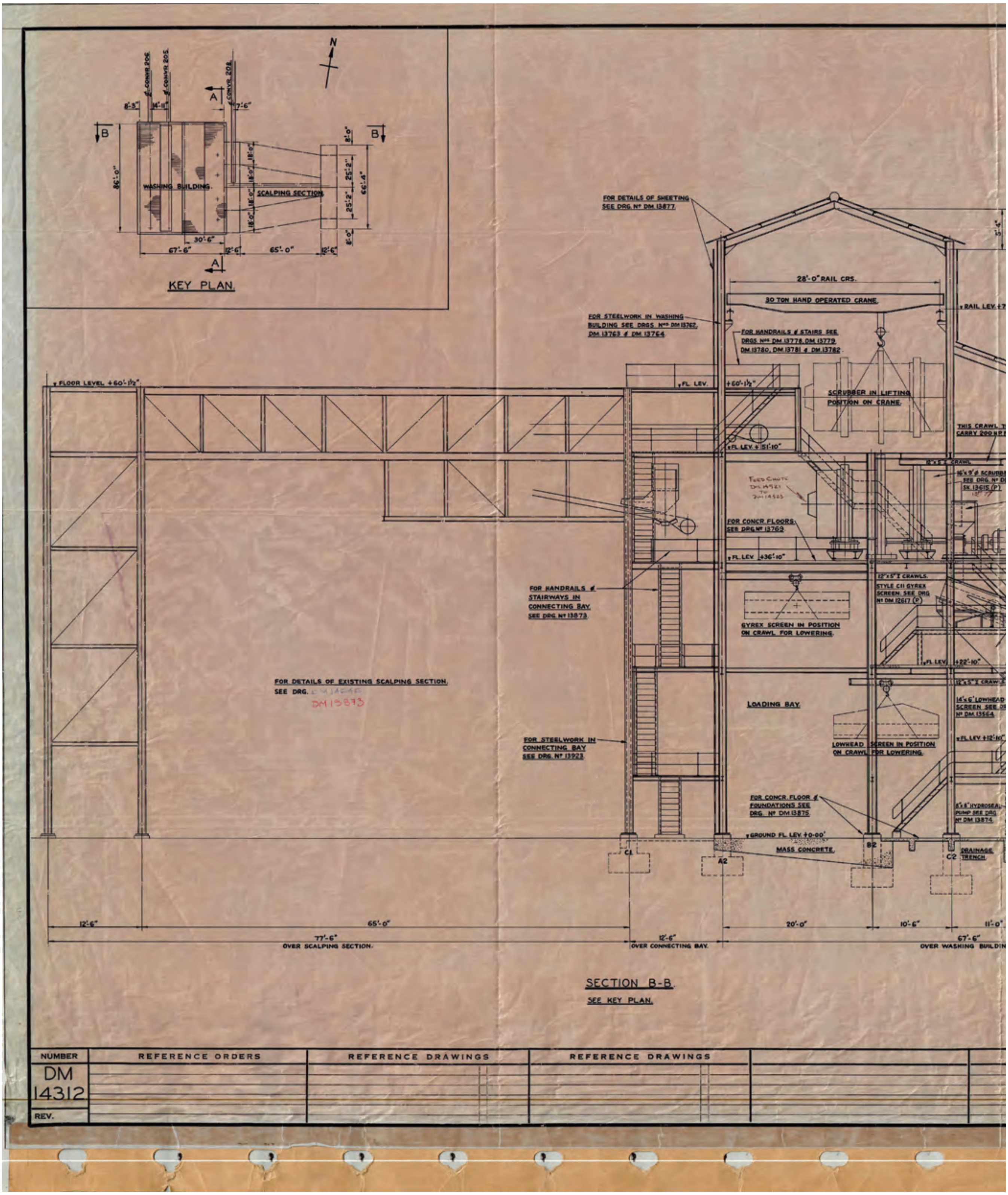
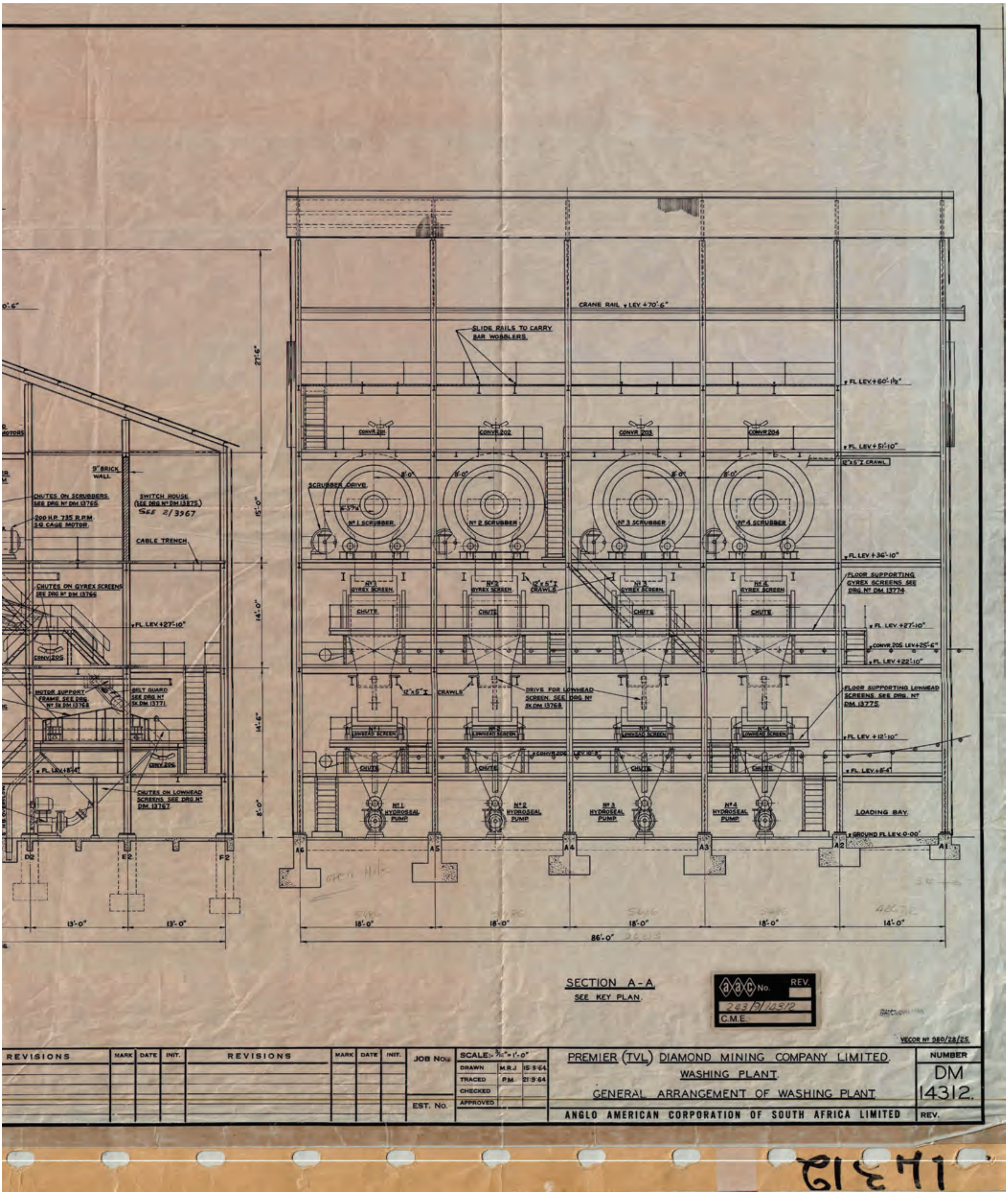


Figure 3.28. Original drawing of the washer plant, chutes and scrubbers (Petra Diamonds 2014).


CRANE RAIL LEV +70'-6"
SLIDE RAILS TO CARRY BAR WOBBLERS.
CONVR 201
CONVR 202
CONVR 203
CONVR 204
Nº 1 SCRUBBER
Nº 2 SCRUBBER
Nº 3 SCRUBBER
Nº 4 SCRUBBER
SCRUBBER DRIVE
CHUTE
LOADING BAY
SWITCH HOUSE
CABLE TRENCH
SECTION A-A
SEE KEY PLAN.
PREMIER (TVL) DIAMOND MINING COMPANY LIMITED.
WASHING PLANT.
GENERAL ARRANGEMENT OF WASHING PLANT.
ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED
REVISIONS
JOB No.
EST. No.
SCALE
DRAWN
TRACED
CHECKED
APPROVED
NUMBER
DM 14312.
REV.
C.M.E.

Chapter 4
Between man and nature

"... the bringing together of apparenlty irreconcilable opposites was the condition of poetry itself..." (August Strindberg in St. John Wilson 2007: 99)

The landscape, industrial machine and human endeavour needs to be reconciled in Cullinan. The new framework as proposed aims to do this by focussing on four nodes along a circular route which follows the circumference of the scar in the landscape. It is suggested that the once the mine (currently the only livelihood of the town) closes, that a multi scalar network of craft industries, educational facilities, tourist attractions and agriculture would continue to support the town. This network does not just rely on one method on one scale, as the mine did, ensuring a more resilient support system (Ernstson, van der Leeuw, Redman, Meffert, Davis, Alfsen & Elmqvist 2010: 532-537).

When the mine closes and focus shifts towards the once industrial landscape of the site it occupied, how would this new framework respond to the need of connecting the people, the industrial heritage, and the landscape? A production node is proposed that breaks up the singular industrial livelihood of the town into smaller production facilities at this industrial site, using the principles of resilience as stated above (Ernston et al. 2010: 532-537). If we are, however considering multiple programs, instead of just one as in the past, wouldn't it be within reason to assume we need to consider different generators of architectural form in the new framework?

Form of the current industrial buildings on site was generated through considerations of optimal function and economic performance. For this reason the industrial heritage of these buildings might be hard to access for users in the new framework. The heritage of these forms are important nonetheless, and a valid argument can be made for keeping these buildings due to their industrial nature. How can new building interventions that widen the network of approaches to form generation within this precinct re-establish the connection between man, nature and the machine?

Figure 4.1. Kimberlite tailings and the Highveld (Author 2014).

4.1 Historical theoretical approaches to form

In order to find an appropriate theoretical approach to the generation of form it is necessary to identify the different historical theoretical approaches to form. This might grant insight into theory that can be used in Cullinan to use form as mediator between the town, the industry and the landscape.

Gelernter (1995: 3) identified five core theories on the generation of form distilled from western architecture. Gelernter explains that none of these theories on their own are able to give a complete account of the generation of form in any specific paradigm, but that a combination of the theories would be able to do so. The theories, and the reasons they do not explain the generation of form completely are as follows:

Theory 1: An architectural form is shaped by its intended function.

This theory argues that the ideal architectural form is latent in the needs of the client, the climate and so on, waiting to be discovered by the designer. Function is a considerable informant on how good buildings are shaped, but this does not explain how buildings of similar program in the same context, like houses and office blocks do not have the same form. One would also expect to find no evidence of a designer's preferences and personality, but this clearly happens.

Theory 2: Architectural form is generated within the creative imagination.

This theory postulates that ideas for architectural form originate within the mind and intuitions of the designer. Whilst this theory explains the personality of the designer evident in building form, it does not explain how similar trends in building forms can be identified during different ages in history, or in different climatic regions. The variety found in building forms is simply not enough to validate this theory as the only informant in form generation.

Theory 3: Architectural form is shaped by the prevailing spirit of the age.

According to this theory, a certain spirit exists in each age, a shared set of attitudes which informs all of the cultural activities of the age, including design and form. This theory however does not explain how some ages appeared to have possessed several ages simultaneously. The differing values of Walter Gropius and Herbert Baker overlapping in the same age comes to mind. This theory also does not explain how new attitudes (spirits of age) toward design comes into fruition.

Theory 4: Architectural form is determined by the prevailing social and economic conditions.

Like theory no.3 this theory asserts that design and other cultural activities fall under the coercive influence of a larger force. Here this force is the economic conditions methods of economic distribution and production in the architect's context. It is however possible to identify similar forms in diverse socio-economic conditions throughout different contexts. Like theories mentioned before, there is also no explanation of why personalities of different architects are evident in work within the same socio-economic conditions.

Theory 5: Architectural form derives from timeless principles of form that transcend particular designers, climates and cultures.

This theory suggests that certain principles of form underlie all good architecture, regardless of the particular circumstances of function, designer or culture. This theory contains two versions. The first version claims that there are certain archetypes of building form derived from geometric possibilities. The basilica is an example of this. It has provided the basic organising principle for Gothic cathedrals, Romanesque churches, Roman law courts and other buildings. The theory postulates that by utilising one of these types one would ensure the appreciation of its timeless beauty and that everyone will understand how to use it. This does however not explain how different types as starting point for a design can produce such a variety of outcomes.

The other version of this theory relies on general principles of form universally applicable to all types of building. An example of this is the five Orders of architecture (Tuscan, Doric, Ionic, Corintian, Composite). Starting with one of these principles it is argued that one could derive any number of new building types. Few architects today however need convincing that the five Orders provide essential principles for architectural form. This is also true for other similar systems. These principles are not specific enough to be convincing.

In these theories we can see two attitudes toward form which pull in opposite directions. The first attitude emphasises external influences on form at expense of the designer, whilst the second emphasises the will of the designer at expense of other factors (Gelernter 1995: 20).
By considering these theories we can recognise the industrial architecture of the proposed site to have a form generated by economic constraints in order to increase production efficiency, by a spirit of the age (the spirit of the industrial revolution) and by its intended function. If we are therefore arguing for diversity in generation of architectural form, another approach needs to be considered.

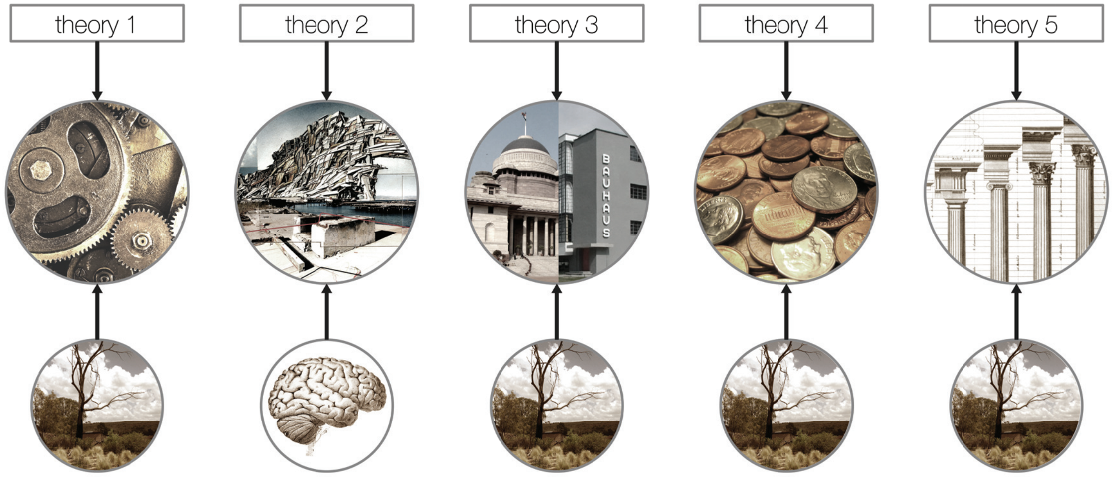


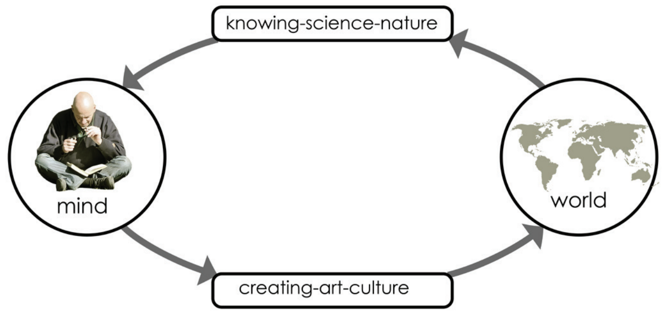
Figure 4.2. The different theories of form generation according to Gelernter (1995) (Author 2014).

4.2 The subject-object problem

According to Gelernter (1995: 27) a certain paradox exists in western philosophy that has a profound influence on design theory and is therefore worth investigating. This paradox is known as the subject-object problem. The problem originated in Greek philosophy when an attempt to explain humans and their relationship to the world was formulated. An individual can be seen as a physical object in nature whose actions and behaviour is completely determined by contextual influences (Gelernter 1995: 27). An individual can just as easily be thought of however, as a freely acting, creative subject, whose behaviour is determined by his or her own desires.

Gelernter (1995: 28) explains that in terms of architectural theory, an equally plausible explanation for design ideas can be chosen between two possibilities. If architects are seen as autonomous subjects who influence the world with their actions, they must generate their own creative ideas and then give them to the outside world. If architects are considered to be an integral part of the world, they must receive information which originate in the outside world (Gelernter 1995: 28). Architects 'create' new information if they are considered to be autonomous subject, but are expected to discover (be a scientist) existing information if they are objects integral to the outside world (Figure 4.3).

If we consider the way in which form was generated historically on the proposed site, we find that it was done considering factors in the outside world. In order to diversify this, we need to also focus on 'creating' (the poetic and beautiful) and not just on informants from the outside world. The author's proposal and the groups suggested framework for Cullinan aims to reconcile nature and culture.



Thus a theoretical premise for the design should ideally try and reconnect nature (object, knowing, science) with culture (subject, creating, art, the mind of the user). It might be useful to investigate if there was a period in history where this was considered, and to tap into that period's theory for this design. Figure 4.4 shows the relation toward Gelernter's explanation of the subject-object problem and different paradigms of western design theory

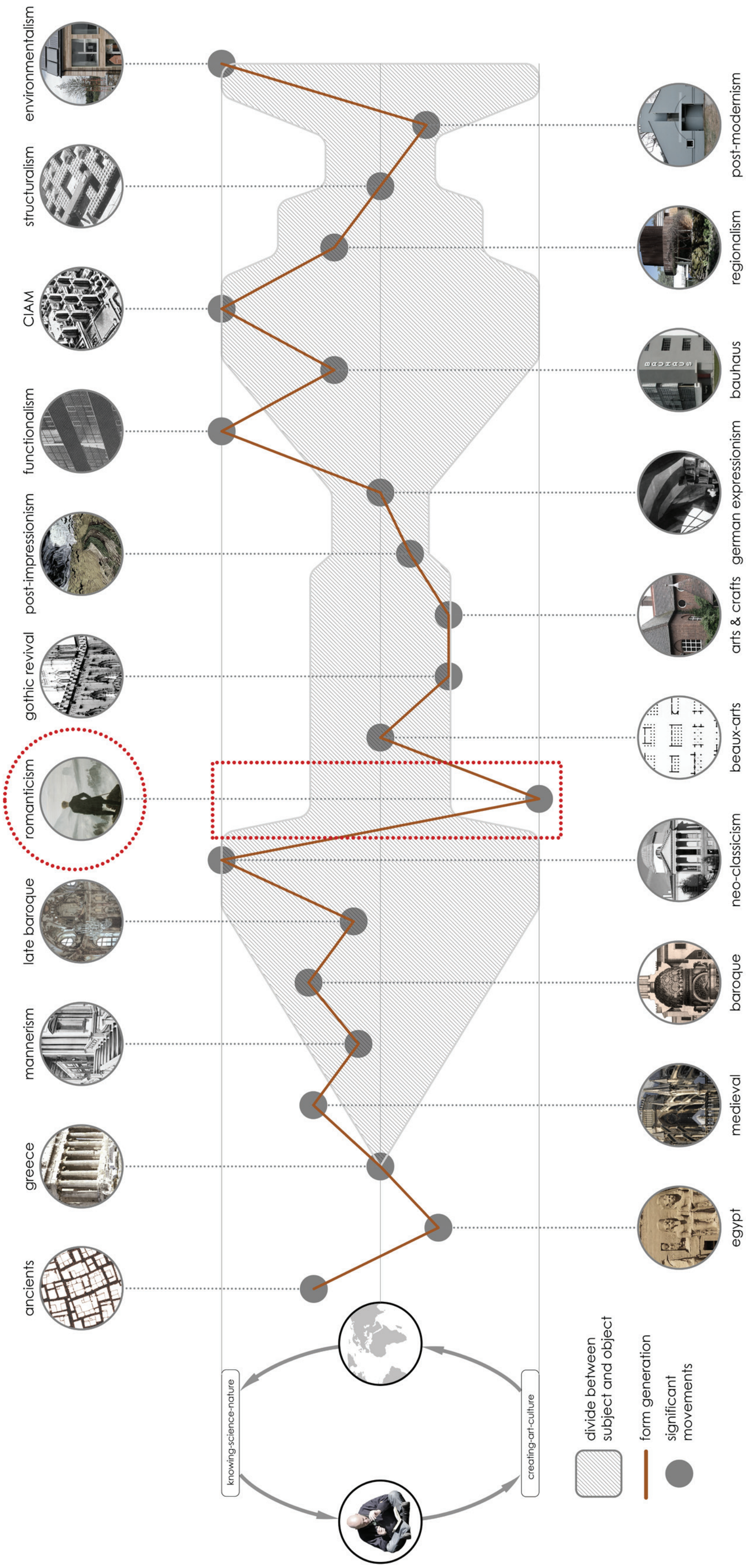
4.3 The Romantic backlash to objective knowledge.

In the opinion of the author, two of the historical design philosophies in western paradigms stand out in their recognition of the subject-object problem and reconciliation of humans and nature through architectural form. These are the Classical Greek philosophies and the Romantic Movement.

Both Gelernter (1995: 29-30) and St. John Wilson (2007: 63) explain that although the sources of form was considered to occur in the natural world (objects) they needed to be creatively interpreted by the designer in Classicism. These designs needed to fulfil a purpose where both function and beauty was in equal consideration.

Figure 4.3. The subject object diagram derived from Gelernter (1995) (Author 2014).

Figure 4.4. Different paradigms and the source of their formal generation according to Gelernter (1995) (Author 2014).


environmentalism
structuralism
CIAM
functionalism
post-impressionism
gothic revival
romanticism
late baroque
mannerism
greece
ancients
post-modernism
regionalism
bauhaus
german expressionism
arts & crafts
beaux-arts
neo-classicism
baroque
medieval
egypt
knowing-science-nature
creating-art-culture
divide between subject and object
form generation
significant movements

'And so we see that the Classical ethos requires of architectural design a strict linear sequence that proceeds from the discovery of what is desirable to the invention of an appropriate form, and thence to the elaboration of the technical means that make it possible.' (St John Wilson 2007: 67)

Gelernter (1995: 31) however explains that although Classicism was aware of the dichotomy of the view of humans in nature they could not find a successful reconciliation between the two. Instead one would be emphasised and then the other without a clear understanding of the relationship between the two. This is surmised in the quote above where we see that a linear sequence was adopted, compartmentalising the dichotomy of subject and object, humans and nature, creation and science.

Let us therefore consider the Romantic movement as source for design theory. The Romantic movement wished to oppose the pure rationalism of the Enlightenment that Gelernter (1995: 153) describes as 'the clearest example yet of a Positivism [rationalism] that makes everything including human behaviour determined by outside influences'.

The philosophies of Immanuel Kant in this period presents us with one of the first intentional theories of reconciliation between humans (subject) and nature (object) (Gelernter 1995: 177). The Romantic movement considered the sublime as a greater source for emotion than beauty. The scale of the landscape of Cullinan can be seen as a sublime object. Its scale forces an emotional response. Also, the industrial architecture in Cullinan is a result of approaches to building form based on purely outside influences and this dissertation aims to propose a varied approach to the generation of form. Due to the similarities of the context of the Romantic movement and the context of Cullinan in the proposed vision it is the author's opinion that theory of this period would be the most helpful in the design of a building that links man and landscape in this setting.

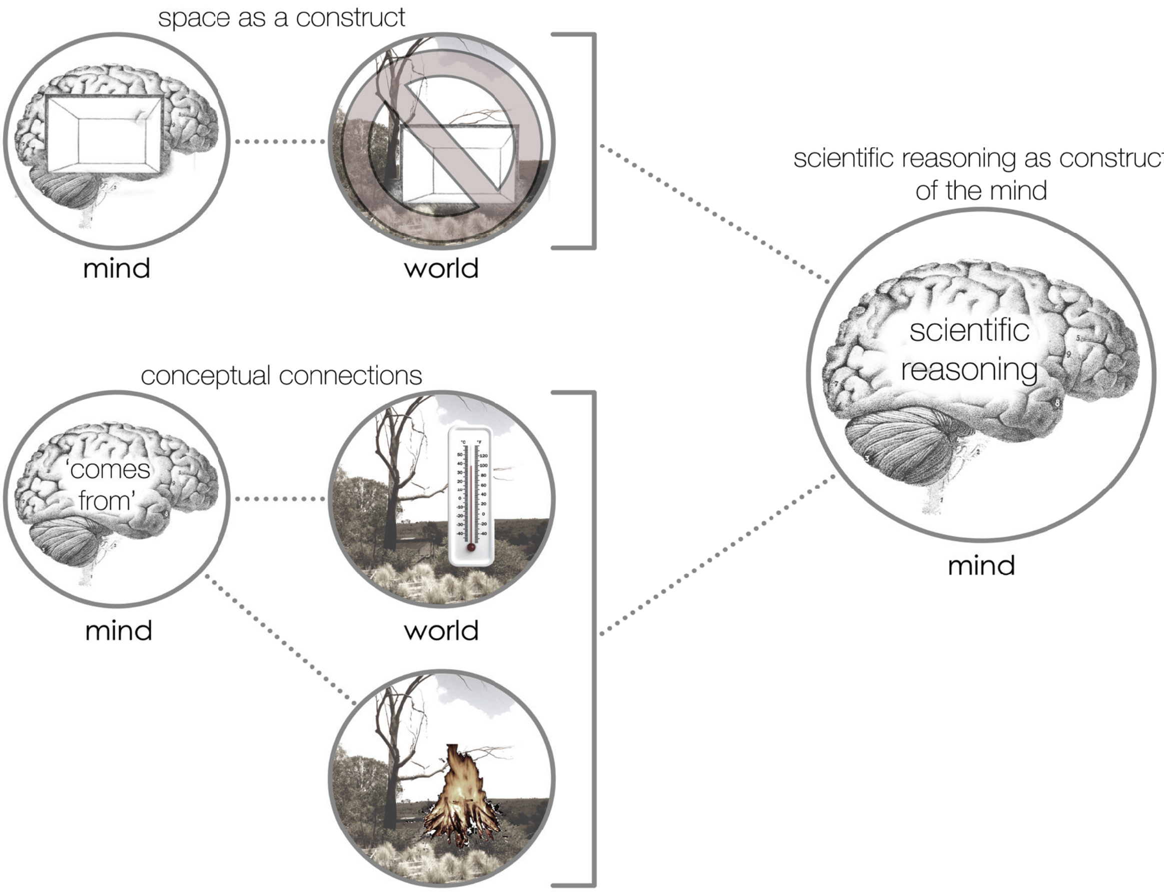
Figure 4.5. (opposite) Kant's transcendentals and their application to perception (Author 2014)

4.4 Kant and form as mode of cognition

In Kant's Critique of pure reason he sets out to explain why it is impossible to consider our rational, objective view of the natural world as the only true method of perception. He did this by formulating three arguments namely the Transcendental Aesthetic, the Transcendental Analytic and the Transcendental Dialectic (Gelernter 1995: 178-180).

The author's interpretation of this is that he argued that space is a construct of the mind (the subject) and not an object in the world (the Transcendental Aesthetic). The Transcendental Analytic then argues that the mind provides the concepts that connect objects perceived in the natural world. For example, a person can, through his/her senses experience 'heat' and 'fire', but only the mind can make the conceptual connection of heat 'comes from' fire (Gelernter 1995: 179). These two conditions then make reasoning based on perceptions and conceptions reliant on the mind and thus rational, scientific reasoning is also based on the processing facility of the mind and can therefore not be a reliable method for perceiving the outside world (the Transcendental Dialectic) (Figure 4.5).

Therefore Kant suggested that purely rational means toward the connection between man and nature is not possible. This resonates with the approach the author is taking toward the design of a building that connects natural landscape and culture.



Kant then went on to suggest that emotions and art might be able to pierce through the heart of reality and reveal otherwise inaccessible truths. Kant suggested that a beautiful object can arouse the mind to a more harmonious state between itself and the object than upon viewing an object with no consideration for evoking emotion (Gelernter 1995: 181).

'In a certain sense the mind is free- wheeling, not seriously directed towards attaining rational knowledge of the outside world, and so is able to enjoy harmony between itself and the object [the outside world or nature]… in fact if the mind does try to subsume the … experience under a rational concept, it disturbs the [emotional] experience and transforms it into a mere rational judgement.' (Gelernter 1995: 181)

In the author's opinion this emotion can also be evoked by an ugly object (a vast scar in the landscape of Cullinan), this sublime quality of an object is not reliant on beauty, but can be experienced upon viewing objects that might seem grotesque and overwhelming (Figure 4.6).

Figure 4.6. The overwhelming landscape of Cullinan (Author 2014).

4.5 Application of this theory to the mediation between culture and nature in Cullinan

Cullinan is a Romantic landscape. The tension between the landscape, the industrial machine and the people of the town caused the intensification of the sublime nature of the landscape through the creation of the scar.

If, as argued, we need to consider a more diverse and resilient approach to the generation of architectural form, this sublime landscape presents us with a resource to be tapped into to evoke emotions within the mind of the user, thereby establishing a link to nature (Figure 4.7). The form of the building needs to facilitate not only the physical link with the landscape through building function, but an imprint of the character of place within the mind of the user through this evocation of emotion.

The theory laid out in this chapter has served as a reference and one of the main generators in design process, which will be described in the design development chapter.

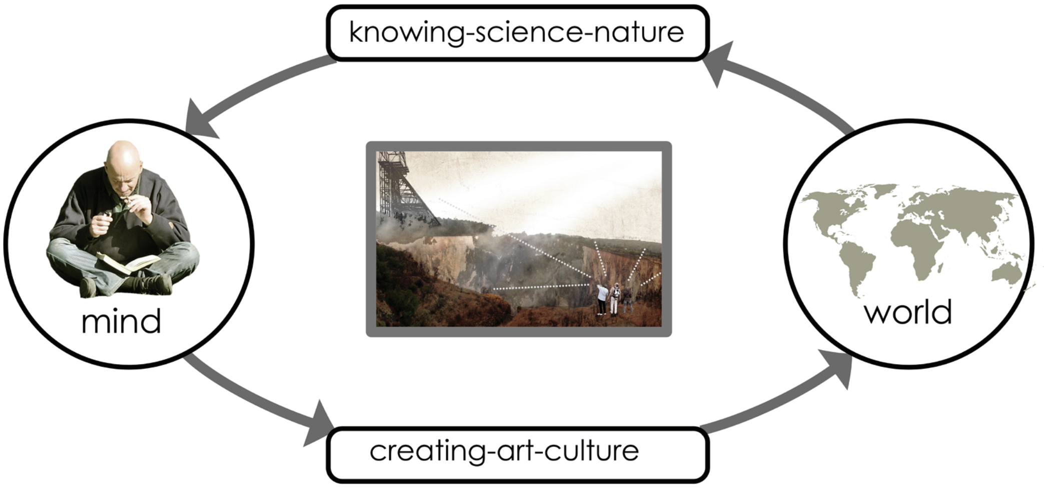
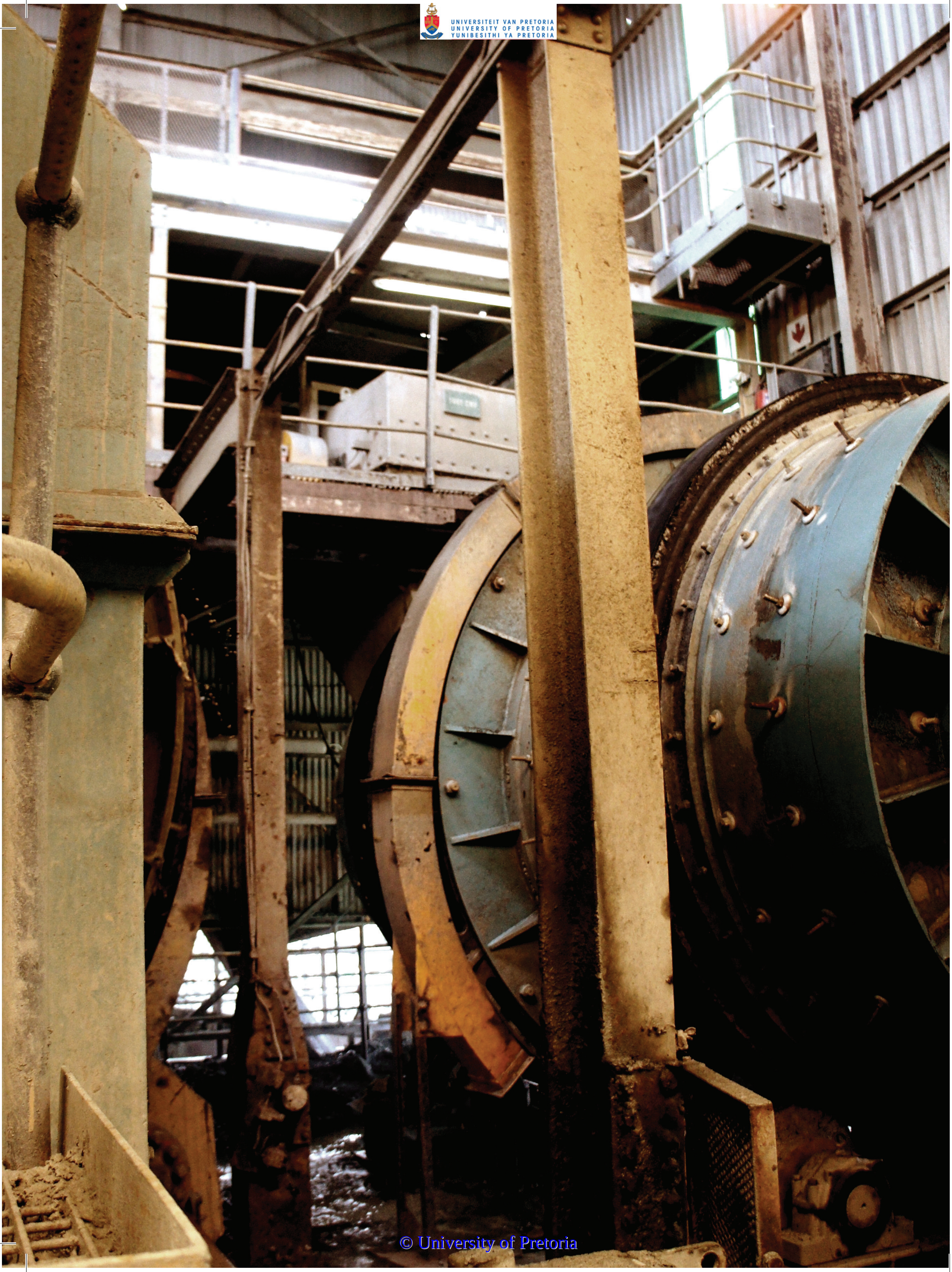


Figure 4.7. The sublime as link between man and nature (Author 2014).



Chapter 5
Program and concept

'Architecture is only authentic when Man is at the Center…' (Mackeith 2006: 187).

5.1 Questioning the industrial

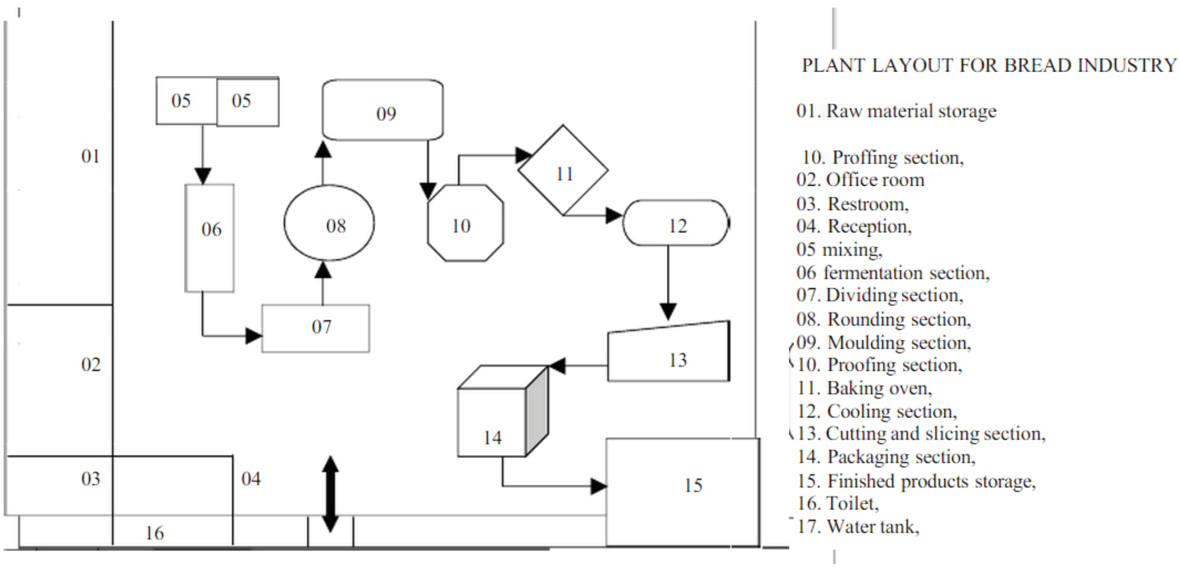
Within the urban vision and theoretical framework it had been established that what is needed in Cullinan, as part of a vision for its resilience, is a reconciliation between man, the natural landscape and the industrial machine. What building program, or approach to the building's program, would aid in this endeavour as well as in the generation of a form to link the user to the landscape?

We should first consider the current dominant programmatic paradigm within the existing buildings (and in fact most industrial landscapes). In the existing washing plant we find the use of massive machines to crush and wash Kimberlite in order to fuel the singular industry keeping the town alive. This is a mechanised industry. To understand why this type industry does not lend itself to the reconciliation of man, nature and the production process we must look into the difference between craft and industry.

'Craft in non-western, "unmodern" societies did not follow the nature-culture bifurcation process brought about in the West by the Enlightenment.' (Taljaard 2013: 23).

Craft practice in non-western societies, where the rationalisation of industry did not have a large impact on production, represented a connection between the natural world and culture. The craftsman's trade was a form of expression, where raw nature was transformed into products, not only objects, but reflections of nature, a way of participating in natural processes (Taljaard 2013: 23). Taljaard (2013: 25) goes on to mention that the detrimental impact of rationalisation on craft (and craft as link to nature) was organisation and politics, in conjunction with mechanisation that lead to the deskilling of labour forces. It was thus not only machinery of the Industrial Revolution that severed craft production's link to nature, but also mass production processes that organised production with emphasis on economy, rather than the craftsmen and his link to the process.

Figure 5.1. The scrubbers in the washing plant (Author 2014).



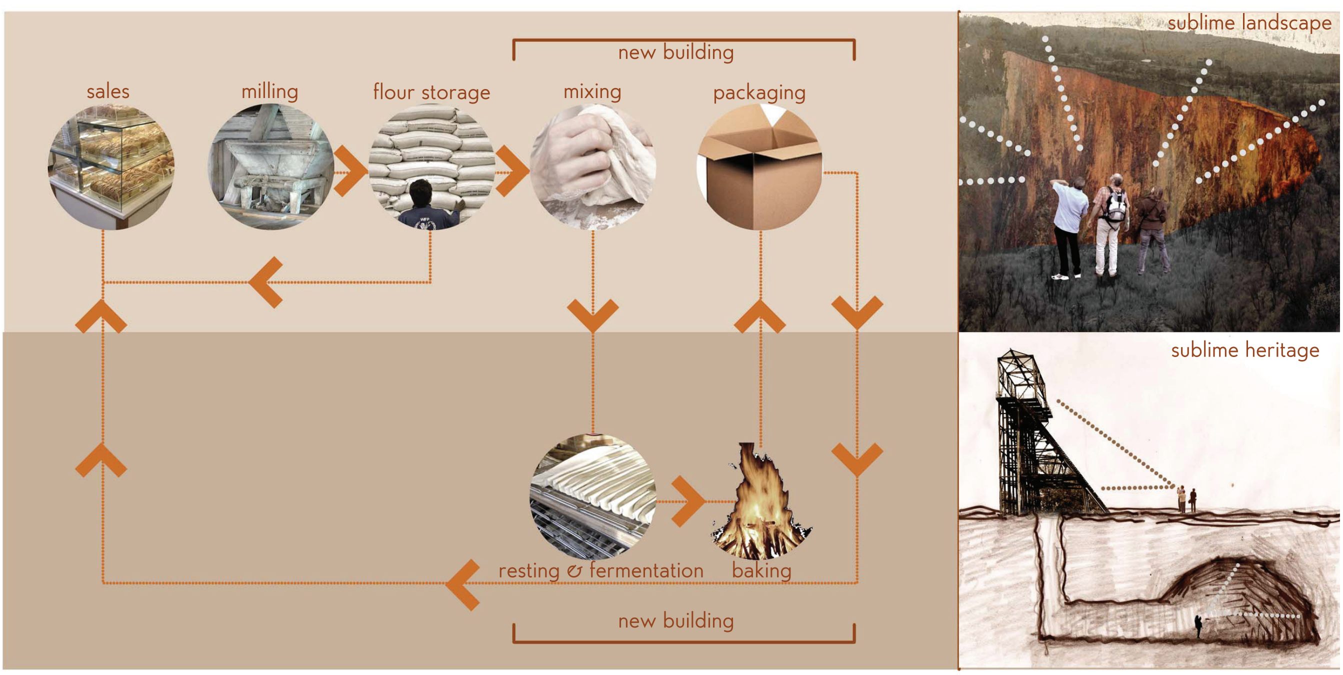


Figure 5.2. (top) Industrial baking process (Scribd 2014).

Figure 5.3. (bottom) Suggested program arrangement (Author 2014).

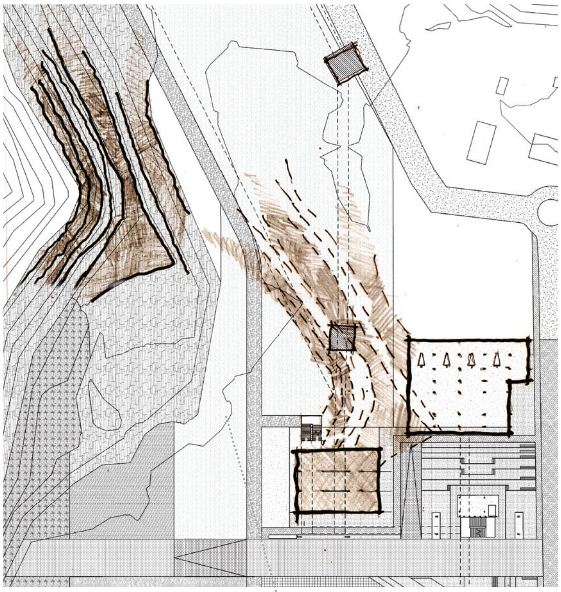
5.2 Appropriate program

There were a few things that taken into consideration when generating a program for the building. The program had to fit into the urban vision and proposed framework. To link into the urban vision it had to connect to the proposed network of industries to replace the mine after its closure. These, as mentioned in chapter 3, are agriculture, tourism and heritage, light industry and education. The proposed framework within the mine, developed by Walter Raubenheimer and Marcel Mattheüs, is seen as the production node in the urban vision, and therefore the proposed program needed to produce wares or consumables. Apart from this the program also needed to address the link between man, nature and industry, just as the form generation needs to.

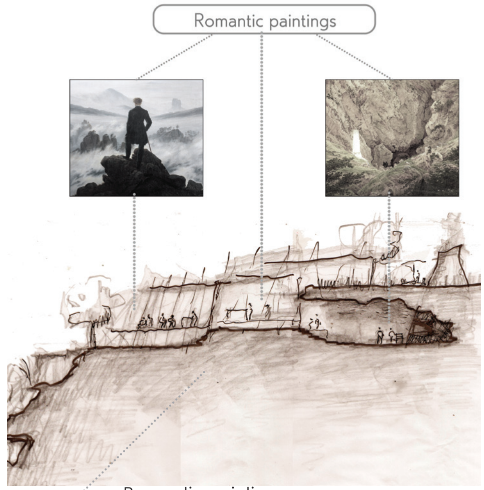
Taking all of this into account, the program is proposed as a bakery and small flour mill. This links into the proposed agricultural industry by receiving raw product from it. It links into proposed light industry and the production node as baked goods are produced, which can be sold to the public and distributed to local restaurants, linking the program to the proposed tourism element. If we question the manner in which the industry conducted in Cullinan was closed off to the townspeople, this program presents us with a way of educating the public in the baking process, linking into the educational element proposed.

The making of baked goods also presents us with an opportunity to reorganise the industrial baking of bread to introduce craft as link between man and nature. In order to do this we first need to look at the way modern industrial bakeries operate. The exact sequence and requirements are further outlined within the technical chapter later on, but what is important to note is that most of the processes in the bakery is done with appliances (machines) and it is a node in a singular space as seen in Figure 5.2 (Scribd 2014). It is therefore proposed that we consider the operation of this program not from the purely economic side, but to also consider this as a craft that can link the user of the building with nature, just as the form aims to do. For this it was proposed to reduce the use of machinery within the baking process, thereby giving the bakery staff (craftsmen) a link to the raw product and therefore nature (as explained in 5.3).

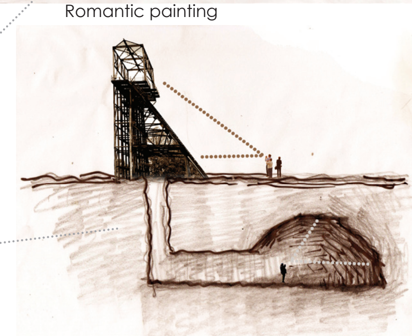
It is also proposed that the different processes take place in different spaces, both to contest the rational organisation that separates industry from craft, and to intensify the experiences that can be generated with the process. If the all the processes are housed in a single space they dilute each other's influence on the space. These different spaces could then relate to the different sublime elements of site (Figure 5.3).



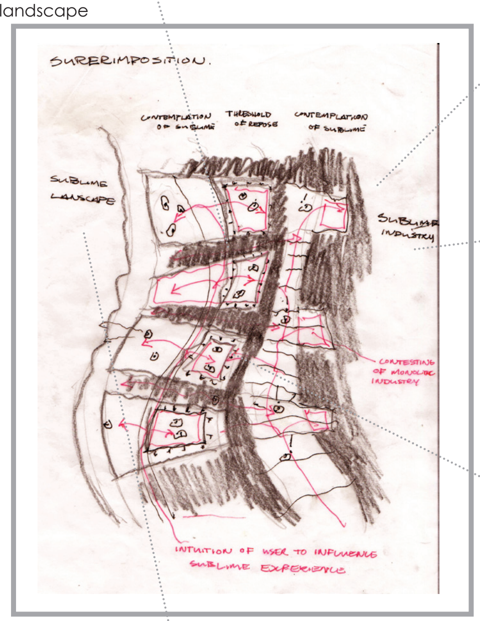
resonance of landscape

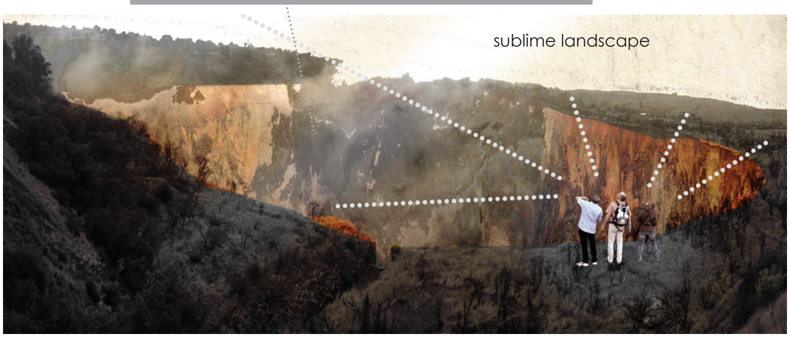


Romantic painting

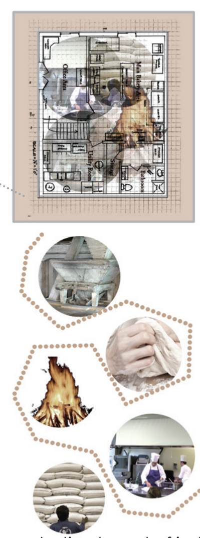


sublime industrial heritage





sublime landscape



contesting layout of industry

CONCEPT

5.3 Conceptual influences

It is also important to note what the conceptual approach was before starting with the design development phase (chapter 6). It has to be noted that at this stage of the design there was no singular all-encompassing conceptual statement, as this concept was refined during the design process. The conceptual approach was comprised of various elements, derived from theory, program and personal intent (Figure 5.4).

The diagram in Figure 5.4 shows the elements that influenced the conceptual approach at the start of the design development. From the theory discussed it was realised that the sublime nature of the site (the natural landscape and the industrial landscape), both that of exposure and enclosure had to be tapped into to create a link to between man and landscape. The precedent of romantic paintings could also present a design resource. The program, although not the primary influence on form, could be manipulated to enhance the link between man and nature through the use of craft industry discussed earlier. Finally, it was realised that the form should be something that is unique to the context and site.

These concepts were explored and during the design development (chapter 6) a conceptual statement was synthesised as building with form as threshold between the sublime elements of the rational extant fabric and the sublime elements of nature.

Figure 5.4. (opposite) Conceptual influences at the start of design development (Author 2014).

Chapter 6
A form in between

'Situated at the interface of culture and nature, building is as much about the ground as it is about built form.' (Frampton 1995: 27)

6.1 Generation of a contextual form.

How would a form that reconciles the natural landscape, the industrial heritage and the user be generated and realised? It is important to know the opinion of the author on strategies for this.

In the above quote Kenneth Frampton touches on the reconciling of nature and culture with the use of building form. Frampton (1995: 26) goes on to explain that although the form of a building can be a grand gesture the detailing of the building must not be considered a mere technical means by which the gesture is built, but is an integral part of how the form is realised, it has 'capacity to articulate both the poetic and the cognitive aspects of its substance'. Steven Holl also comments on this with the following quote:

'This [the technical detailing] is a kind of vocabulary, in the way that words are for the writer… if a block of words is put together with a certain talent, it possesses both a soulful expression and multiple meanings.' Steven Holl (Mackeith 2006)

It is the opinion of the author that the proposed building form has to be articulated with detailing that, just like the overall formal gesture, has to evoke emotions. This will enable the user to experience the relationship with the landscape on a small, medium and large scale. This concept behind the construction and detailing of the building will be further explored in the next chapter.

What will be the generators then, for these forms, both on a large scale and the scale of technical detail? St. John Wilson (2007: 83-85) presents us with two approaches to the generation of form in context that originated in the Modern movement.

If we consider the work of Le Corbusier, what can be seen is the goal of 'harmony' to be derived from the contemplation form and the 'knowing and correct play of forms' (St. John Wilson 2007: 83). The composition is generated from a pre-existing canon of forms to be in harmony with its context, much like what was taught at the Ecole des Beaux-Arts. Similarities between this approach and the Classical theories as stated before can be seen, but the author questions the applicability of this theory in that although the composition of form might establish a connection between nature and culture, the forms generated is not necessarily related to the site, and therefore the emotions evoked by the design might be from a different source.

Figure 6.1. A plan exploration of the building form done in June 2014 (Author 2014).

The other theory St. John Wilson speaks of is generated from statements by both Aalto and Haering which were 'we cannot create new form where there is no content' and 'we must examine things and allow them to unfold their own forms' respectively. Herein we can see an approach of generating forms unique to the site as opposed to the formal mastery in composition by Le Corbusier (St. John Wilson 2007: 83-84). This sentiment is resonated by the following quote by Kenneth Frampton:

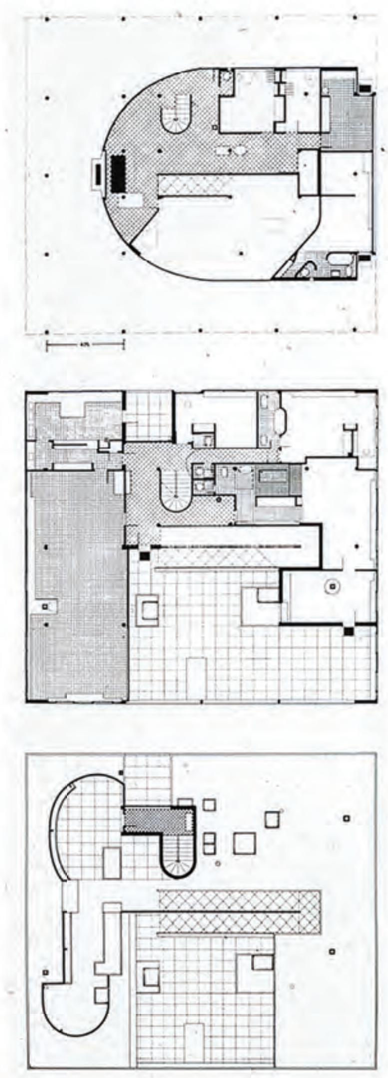
'Close to agriculture, its task is to modify the earth's surface in such a way as to take care of it … Hence the notion of "building the site"… is of greater importance than the creation of free standing objects…' (Frampton 1996: 27)

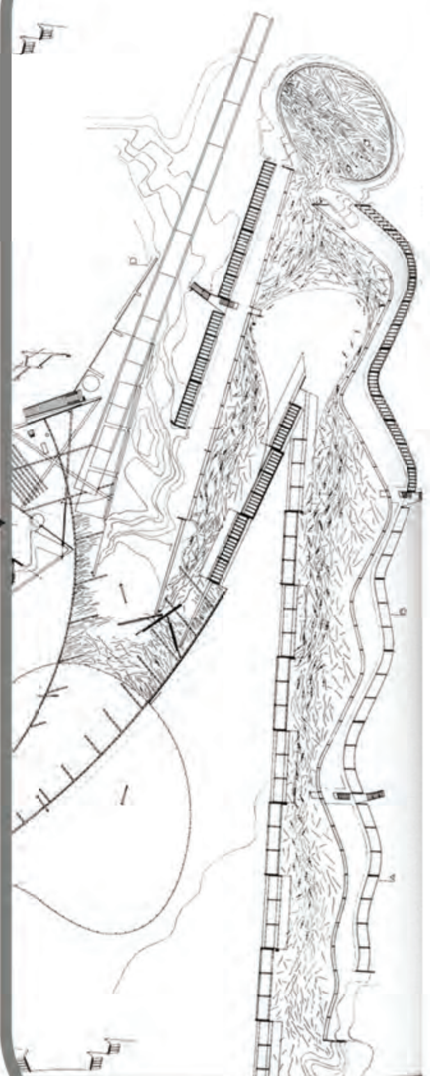
The approach to the generation of form in the landscape appropriate to the specific conditions of the theoretical and spatial framework of Cullinan, is believed by the author to be a re-composition and resonance of elements on site that forces an emotional response by tapping into the site's sublime nature.

This form must be evident in the way the building is realised (technical detailing). The detailing and the engagement of all of the user's senses are essential building blocks of the overall gesture and the emotions it evokes, which will be the link between the user's mind and the natural landscape.

Figure 6.2. (opposite) two possible generators of form in context: a composition of canonical form (Le Corbusier) and response and recomposition of exiting forms (Enric Miralles) (Author 2014).

form in context: two possible options





6.2 Blind doodling

The next question that was raised was that of how to start the design process. A previously mentioned quote by Gelernter (1995: 181), where he interprets Kant's theory on how emotions evoked by the sublime could allow the user of a space (the subject) to gain a better understanding of a space (object) was used as a setting out point for the exploration of a building within the context.

'In a certain sense the mind is free- wheeling, not seriously directed towards attaining rational knowledge of the outside world, and so is able to enjoy harmony between itself and the object [the outside world or nature]… in fact if the mind does try to subsume the … experience under a rational concept, it disturbs the [emotional] experience and transforms it into a mere rational judgement.' (Gelernter 1995: 181)

It was difficult for me to embrace the idea of the generation of form through intuition. This is because all of the previous projects I have worked on have been approached in a rational way. It was important however to design in a way as set out by the theory discussed. My understanding of the above quote was that it is important to design with an intuitive formal response to the landscape if the users are to have an intuitive emotional response to the building form, and therefore the site, which can grant them different perceptions of the site than mere rational observation. This is emotional response from the user can of course be achieved through any other sequence of design, but because the one of the aims of this dissertation was to facilitate my growth as a designer, the design was approached differently. `

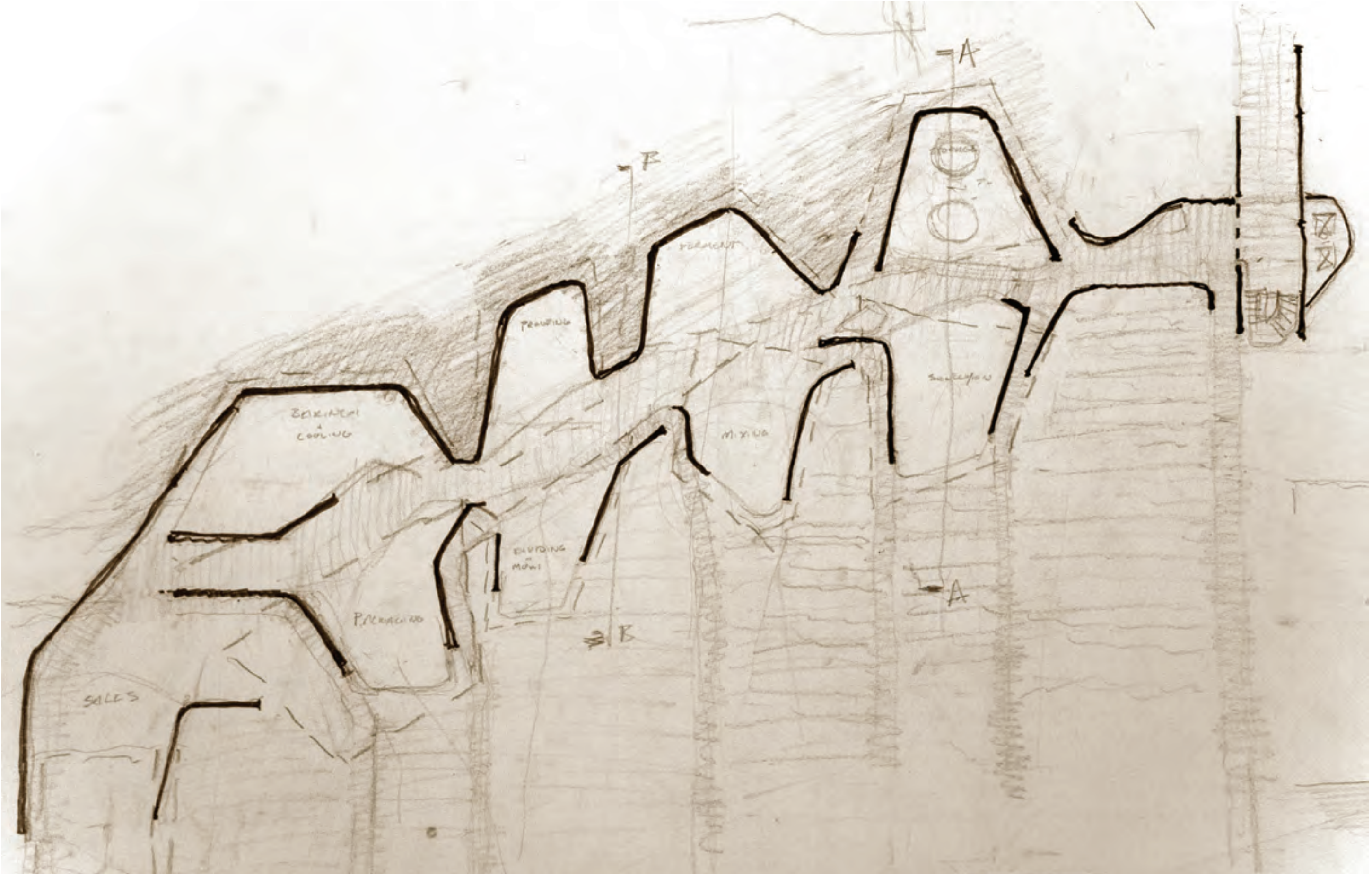
I realised that I was not yet comfortable enough in my abilities to 'free-wheel' while designing. This skill needed to be developed if I was to design a building which evokes a romantic link between the landscape and the user through form. Thus, without focussing too much on the rational aspects of the design, I just started to draw a building in the context, hoping that some value could be found within this intuitive response. This exercise was also valuable as a way to start gaining confidence in my intuitions in the generation of form. The results of this exercise can be seen in Figures 6.3 to 6.8. A model was also built following this same principle (Figures 6.9 to 6.12).

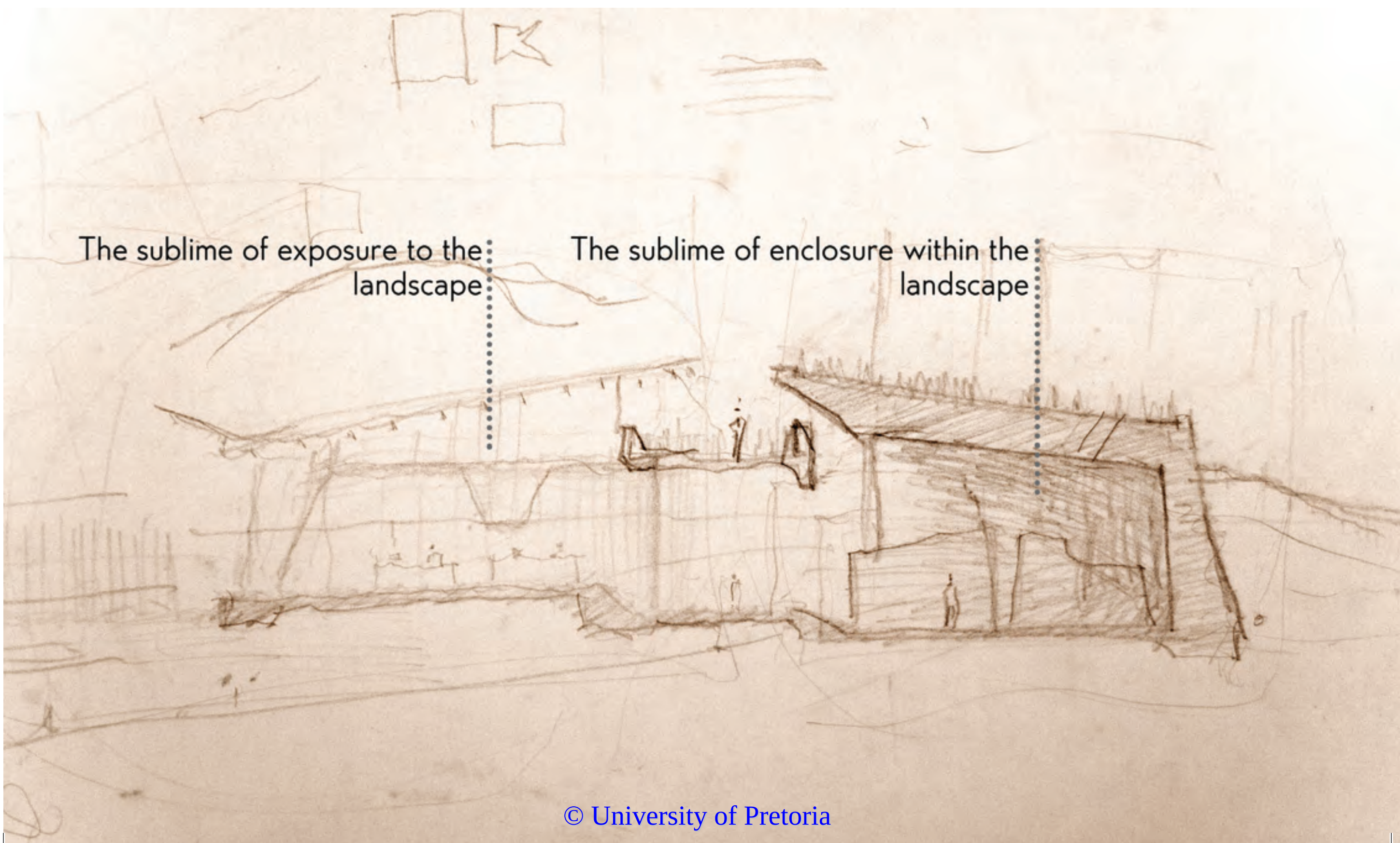
Although these drawings and the model were very one dimensional if regarded as a design for a building, I could still see certain elements emerging that was mentioned in the concept chapter. In Figures 6.4, 6.5 and 6.8 it can be seen that one of the main aspects of the concept started to emerge. This is the concept of the sublime experiences created by the vast landscape, exposure to scale, and the sublime experiences created by the industrial heritage, the enclosure of the user within the earth. In the model we can see hints of a building that circulates the user into underground enclosed spaces, and then linking those spaces to the exposure of the natural landscape. This was identified as an important concept that can be seen throughout the iterations of the design to come.

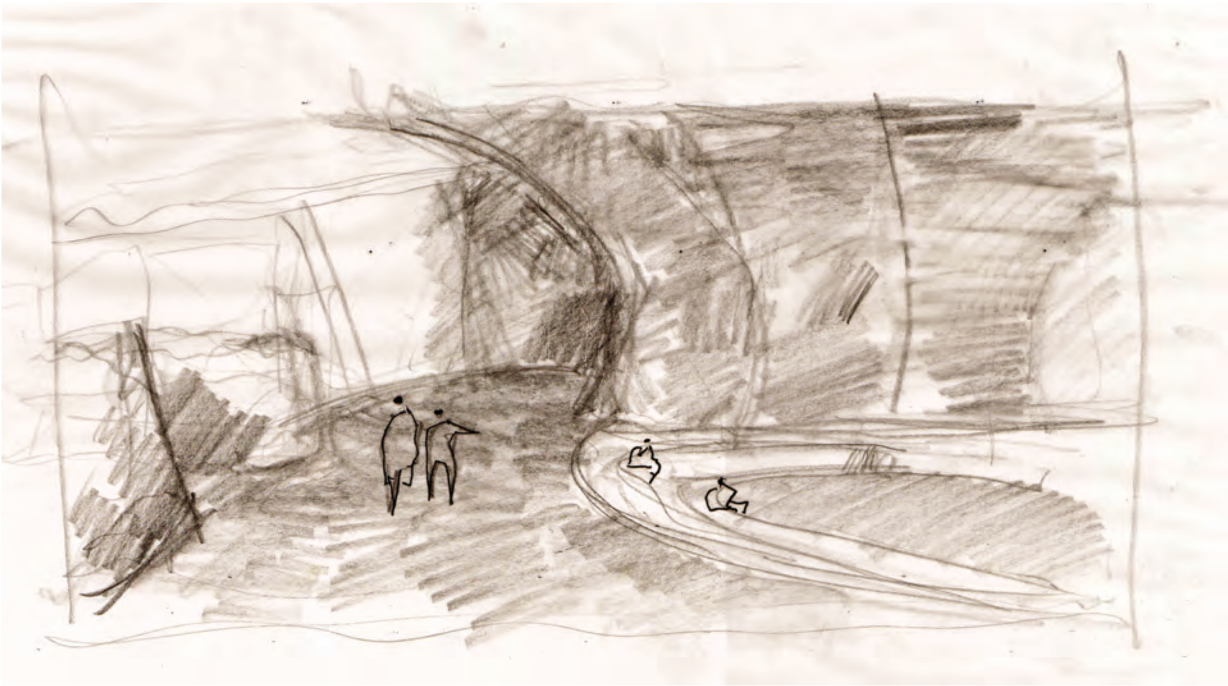
Another insight that was gained with this exercise was the fact that I did not yet have an intimacy with the site required to facilitate a form generation that, as stated in the previous section, recomposes the site and resonates with it.

Figure 6.3. (opposite top) Early plan exploration (North is up) (Author 2014).

Figure 6.4. (opposite bottom) Early sectional exploration (Author 2014).




The sublime of exposure to the landscape
The sublime of enclosure within the landscape



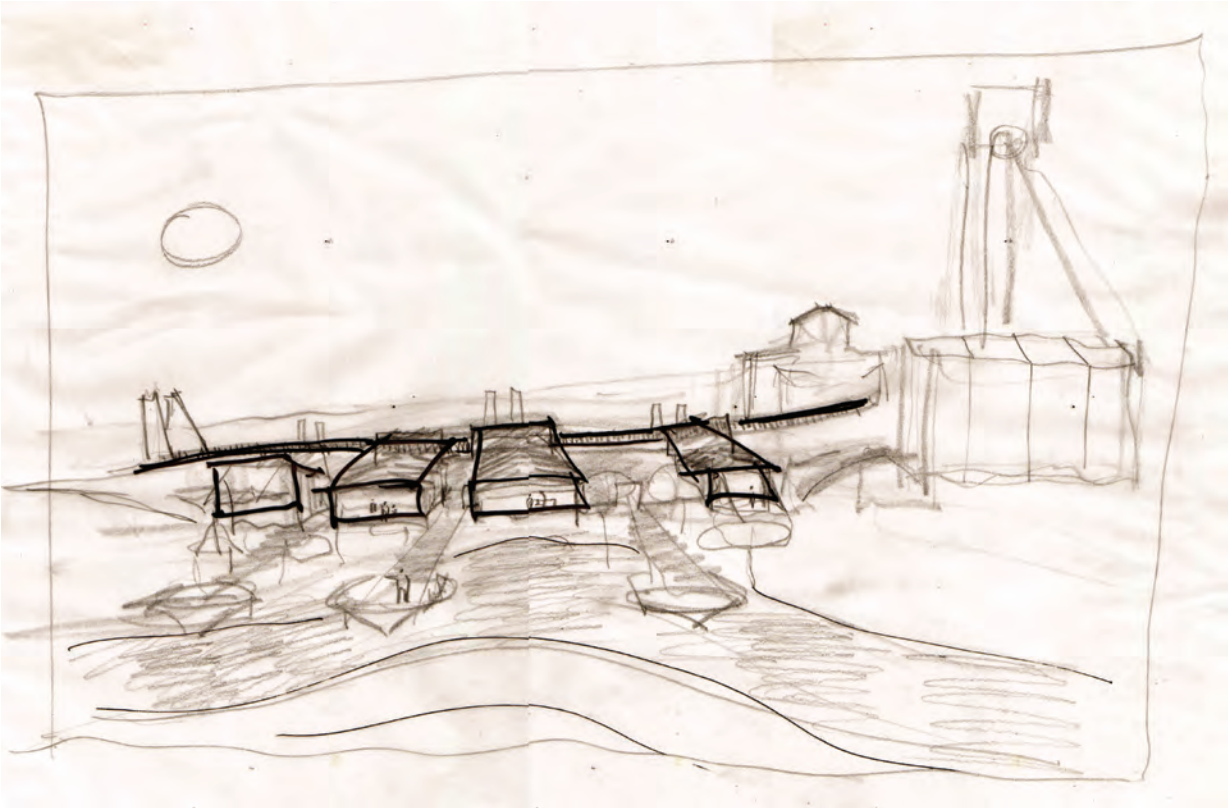


Figure 6.5. (top) Sketch showing an enclosed space (Author 2014).

Figure 6.6. (bottom) A conceptual elevation with paths linking to the landscape (Author 2014).

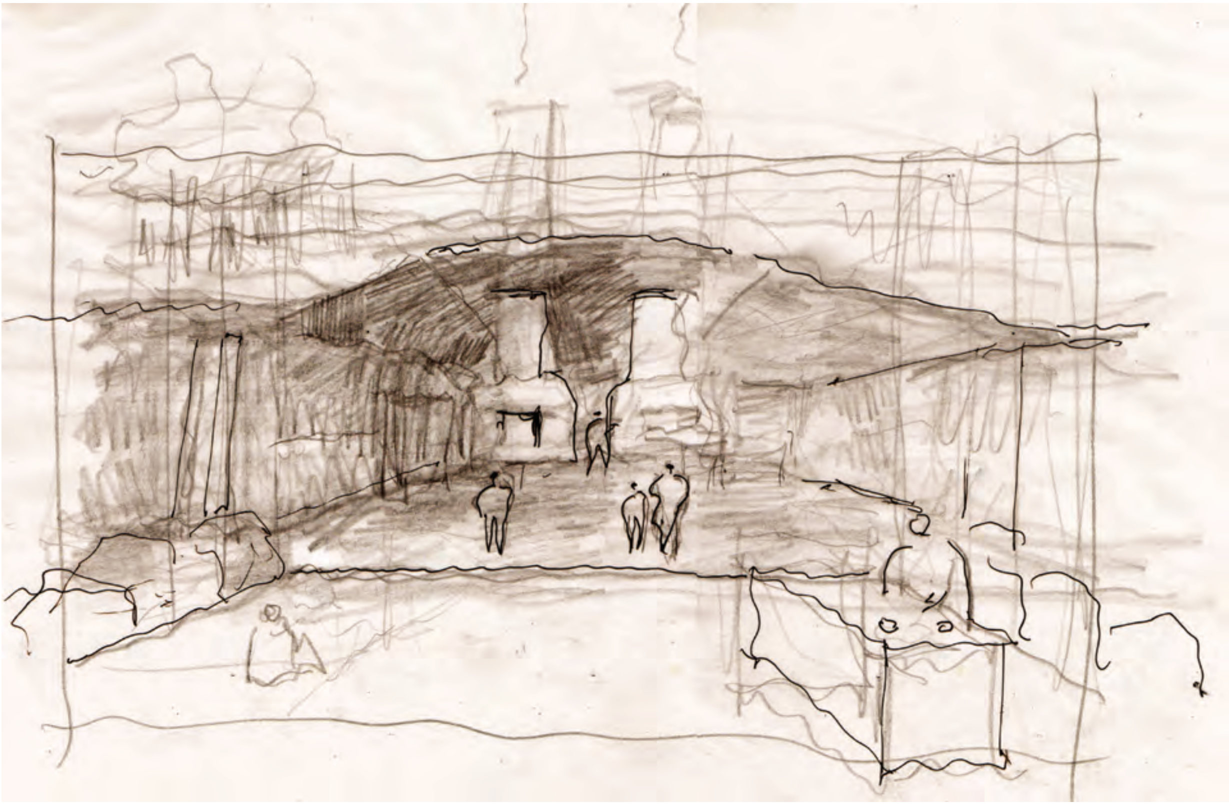
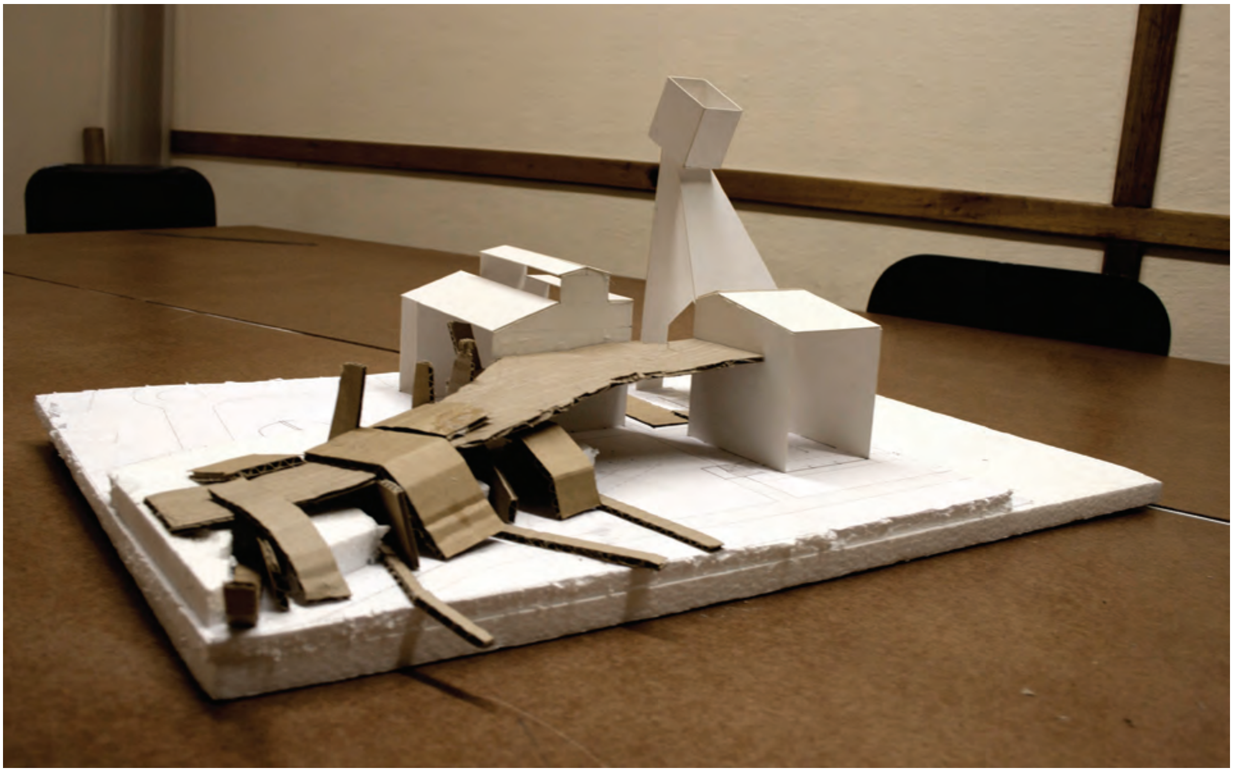


Figure 6.7. (bottom) The sublime link to the landscape. A conceptual interpretation (Author 2014).

Figure 6.8. (top) A sketch showing both enclosure and exposure (Author 2014).



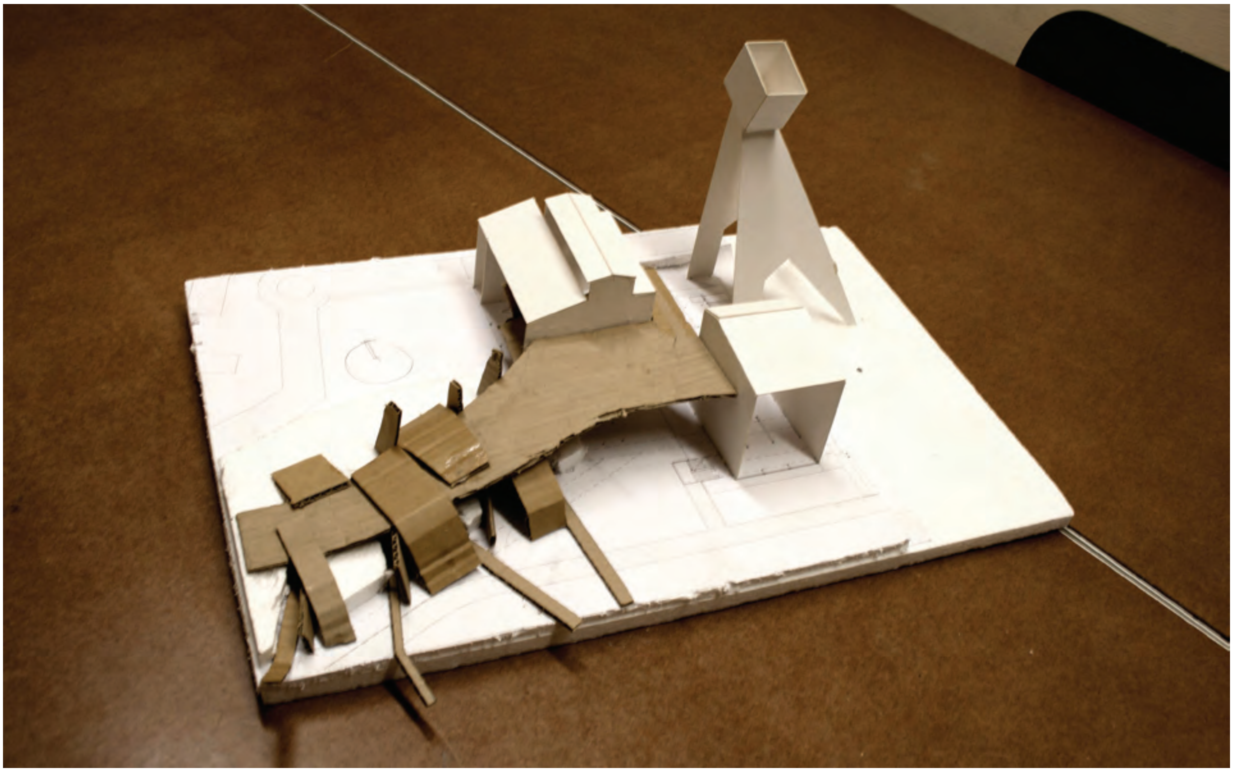


Figure 6.9. (top) Conceptual model, view from Southwest (Author 2014).

Figure 6.10. (bottom) Conceptual model, bird's eye view from Southwest (Author 2014).

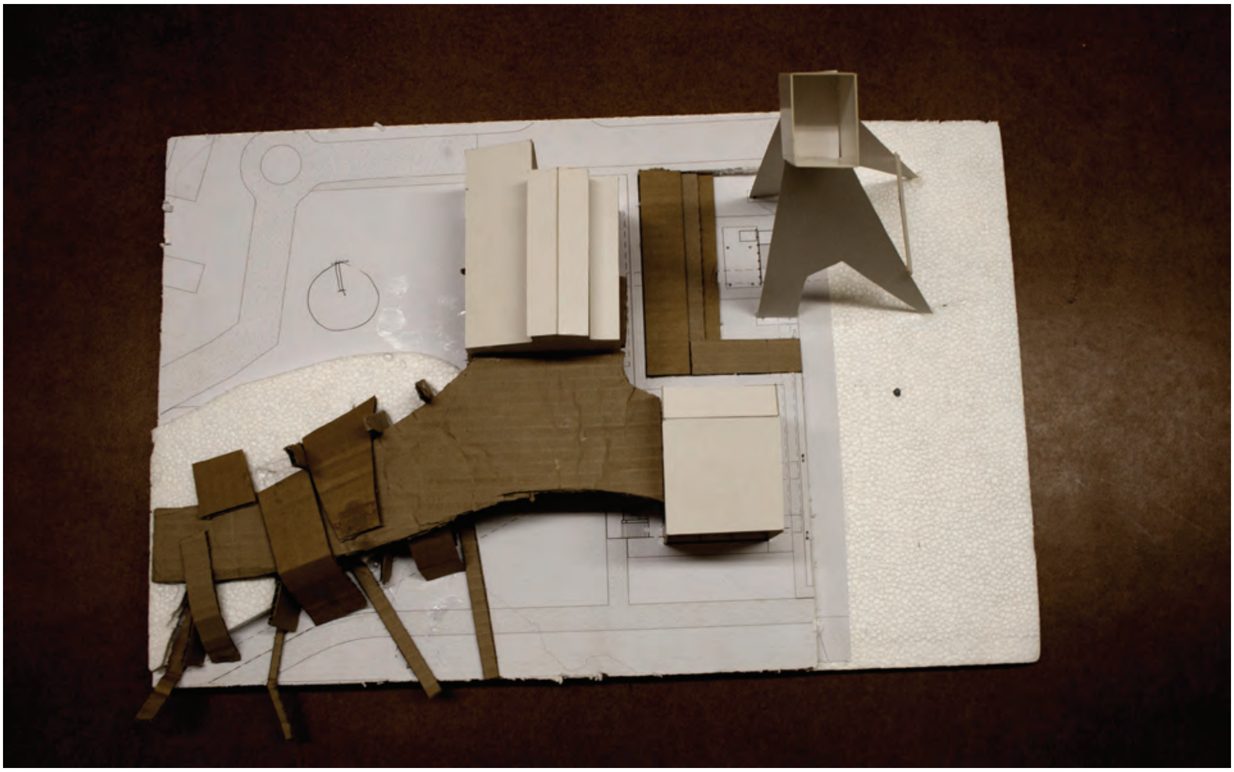


Figure 6.11. (top) Conceptual model, view from Northwest (Author 2014).

Figure 6.12. (bottom) Conceptual model, top view (Author 2014).

6.3 Getting to know the site

The previously mentioned statements by Aalto and Haering which were 'we cannot create new form where there is no content' and 'we must examine things and allow them to unfold their own forms' (MacKeith 2007: 83-84) came to mind once it was realised that I did not yet have an intimate relationship with the site. I was trying to unfold new forms on the site without taking heed of the content and examining the site.

This brought up a new question. The site's content is an object within the rational world, how then do I take this into account within the intuitive exploration of form? I attempted to negotiate this problem with the following exercise.

Figure 6.13 shows a diagrammatic drawing of the site and its elements. The existing washing plant and proposed public square (1), the Kimberlite tailings reservoir (2 and 4), the road and open area behind the washing plant (3) and the open pit (5) are depicted. In order to respond to these elements of the site without making a mere rational observation, a quick sketch was made in response to the atmospheres in those spaces and the emotions they generated. These sketches were then analysed in order to generate statements which could be kept in mind whilst the design was developed further in plan and section. Thus although there is a rational response to the elements on site, they would always have an intuitive response connected to them. What follows are the sketches and the statements generated regarding them.

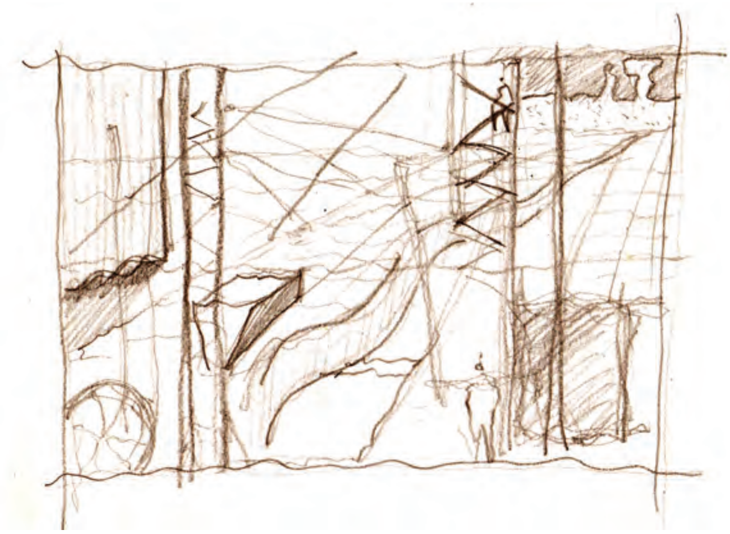
Figure 6.14, the washing plant and public square:
Clutter forces the eye to seek perspective lines that escape into the landscape thus experiencing the scale of the industrial.

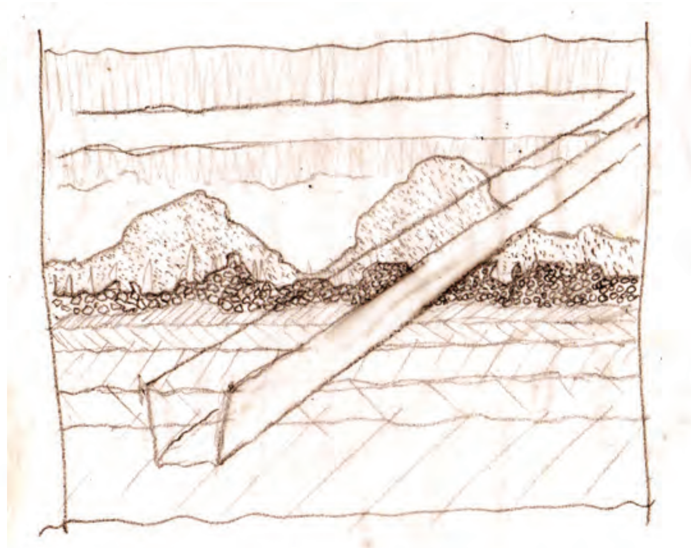
Figure 6.15, the Kimberlite tailings reservoir:
Layering over time, cut and scarred with no time for repose.

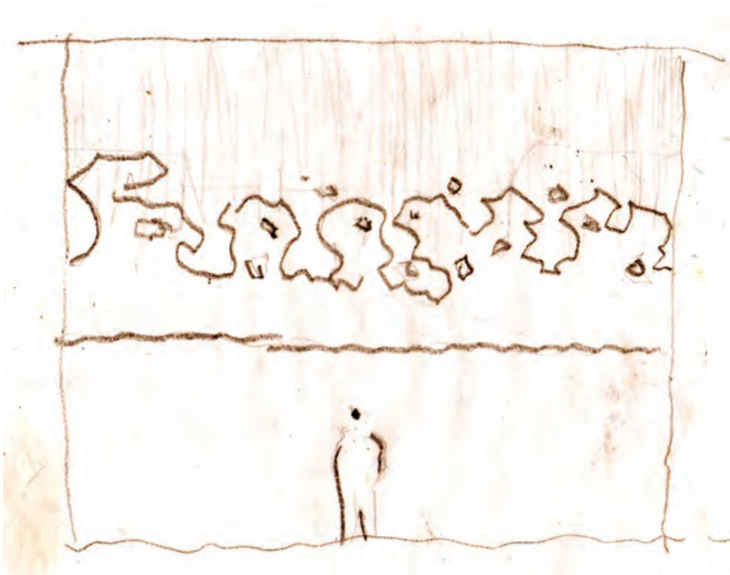
Figure 6.16, the road and open area behind the washing plant:
Intense exposure to the vast landscape, but isolated from it

Figure 6.17, the open pit:
The threshold with the sublime decays. Permanence is interspersed.

Figure 6.13. (this page) Diagrammatic site legend, North is up (Author 2014).







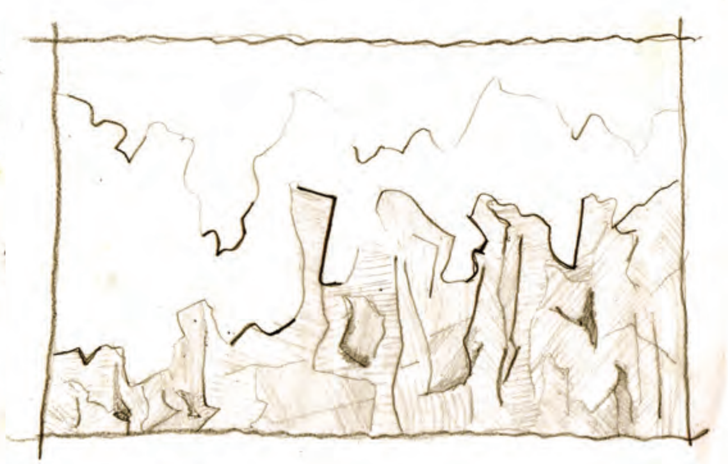


Figure 6.14. (top left) Sketch in response to the washing plant and public square (Author 2014).

Figure 6.15. (top right) Sketch in response to the Kimberlite tailings reservoir (Author 2014).

Figure 6.16. (bottom left) Sketch in response to the road and open area to the North of the washing plant (Author 2014).

Figure 6.17. (bottom right) Sketch in response to the open pit (Author 2014).

6.4 Plan and section, draw, draw, draw...

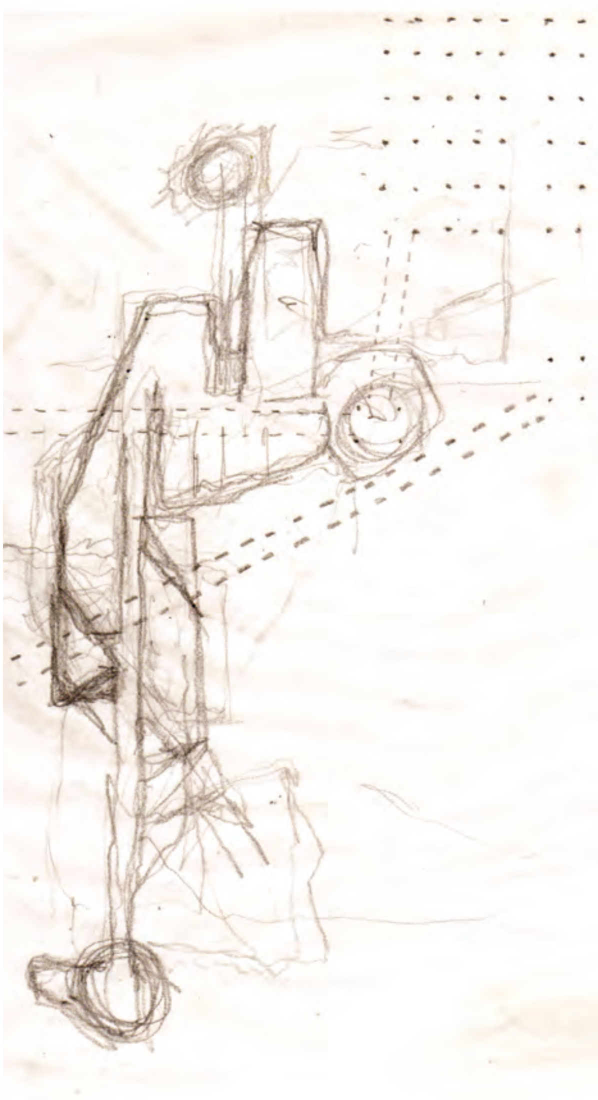
Having acquainted myself more thoroughly with the site, I started exploring the plan-form and section of the building. Figures 6.18 to 6.23 show the development of plan and Figures 6.24 to 6.27 show the development on section, before the concept development feedback, on a scale of 1:500. During all of these numerous drawings, the previously mentioned aspects of the concept that emerged strongly (the sublime of exposure and enclosure) were taken into account. A certain response to site, relating to the intuitive sketches made in section 6.3 was always kept in mind in each of these explorations, although some aspects are more clearly evident in some than in others.

After these were done, I used Figure 6.23 (plan) and Figure 6.25 (section) and developed them into rough 1:200 explorations of how the building and spaces might be designed if the program was also taken into consideration. These diagrams were picked purely because they were the last ones that were done before the deadline. The 1:200 drawings are shown in Figure 6.30 and 6.31.

Although these 1:200 plans and sections were still very naïve, they already started to show connections to concepts explored earlier. A building which links the user to the vastness of the exposed sublime landscape and the enclosures of the underground sublime spaces inspired by the industrial heritage. A structure that decays from solid, heavy materials towards a lightweight structure. A building that is sunken into the ground to stabilise the layers of the Kimberlite reservoir. All of these aspects are a result of the previous exercises in 6.2 and 6.3 and are also seen in later iterations.

An important piece of feedback that I received in the concept development presentation was that I should not necessarily just develop the latest diagram in the sequence of exploration, but that I should critically evaluate which one had the most potential for the proposed program. The sections also did not look like that of a building which belonged in the landscape, but rather like those of a building on the landscape.

After considering this, I focussed my attention on the diagram Shown in Figure 6.21. This plan has a radial form, which could potentially present the best way of organising the program within the form, giving the opportunity to move raw materials and staff radially between the spaces created by the pathways leading into the landscape, which lead visitors on an exploration of significant features in the landscape. I also reconsidered the sectional diagrams as a roof unfolding over and dissolving into the landscape (Figures 6.27 and 6.29)



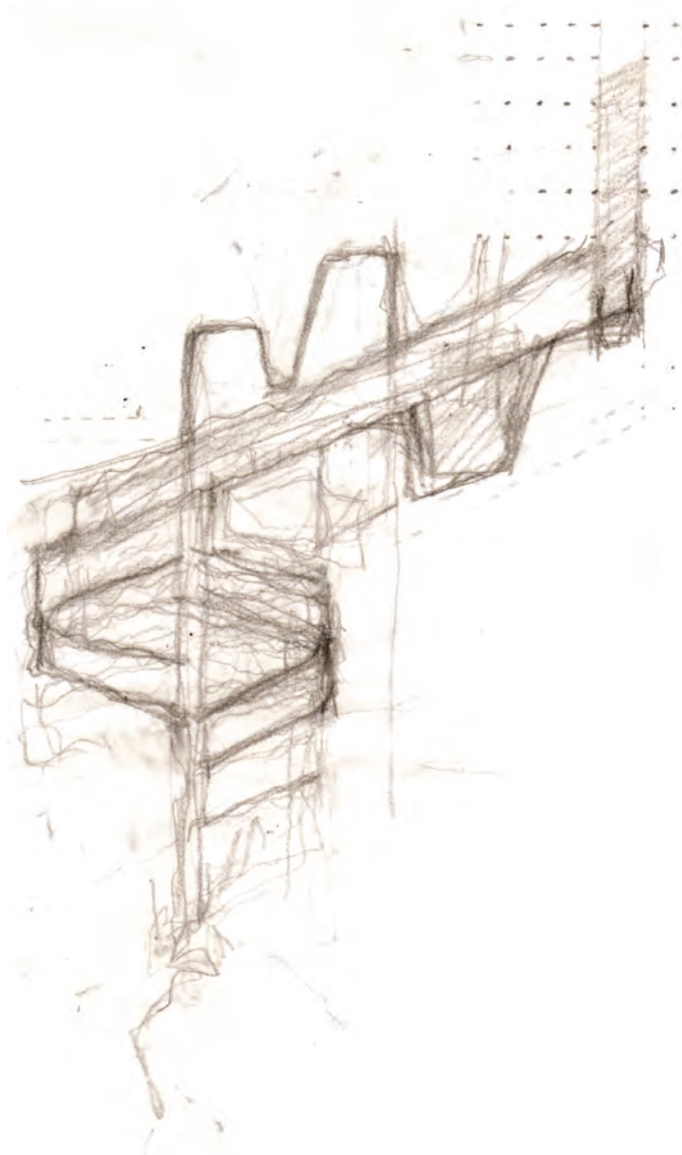


Figure 6.18. (left) Plan exploration 1 (Author 2014).

Figure 6.19. (right) Plan exploration 2 (Author 2014).

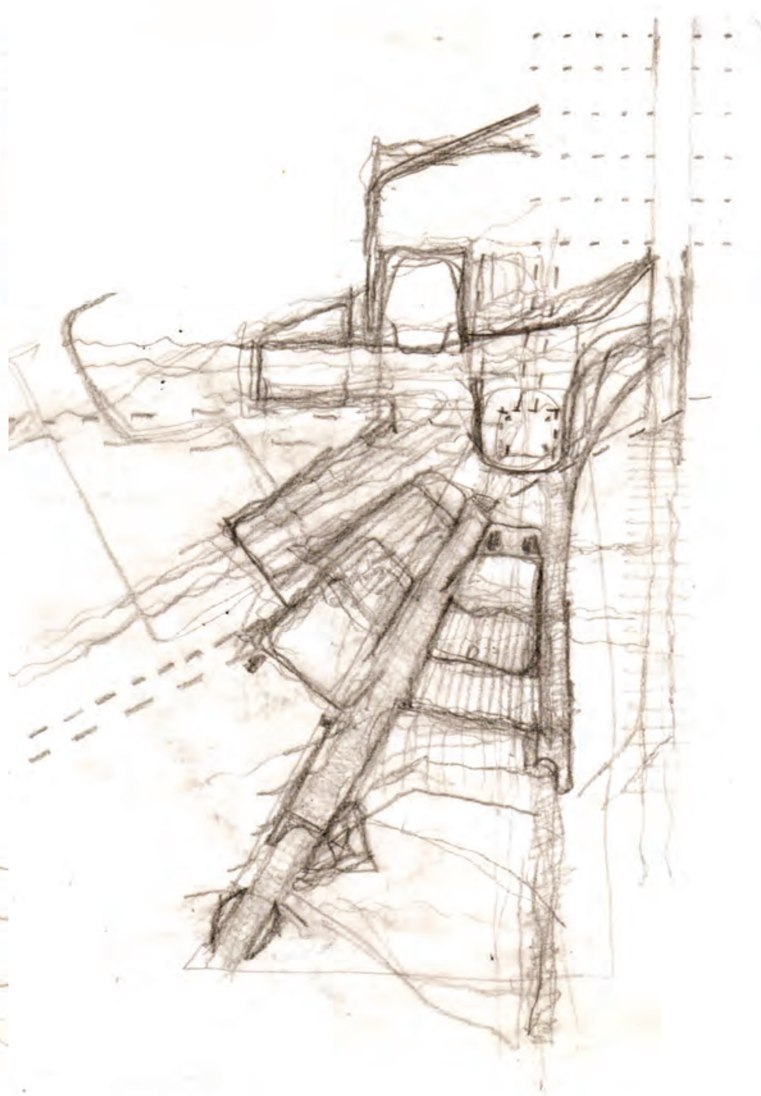


Figure 6.20. (left) Plan exploration 3 (Author 2014).

Figure 6.21. (right) Plan exploration 4 (Author 2014).

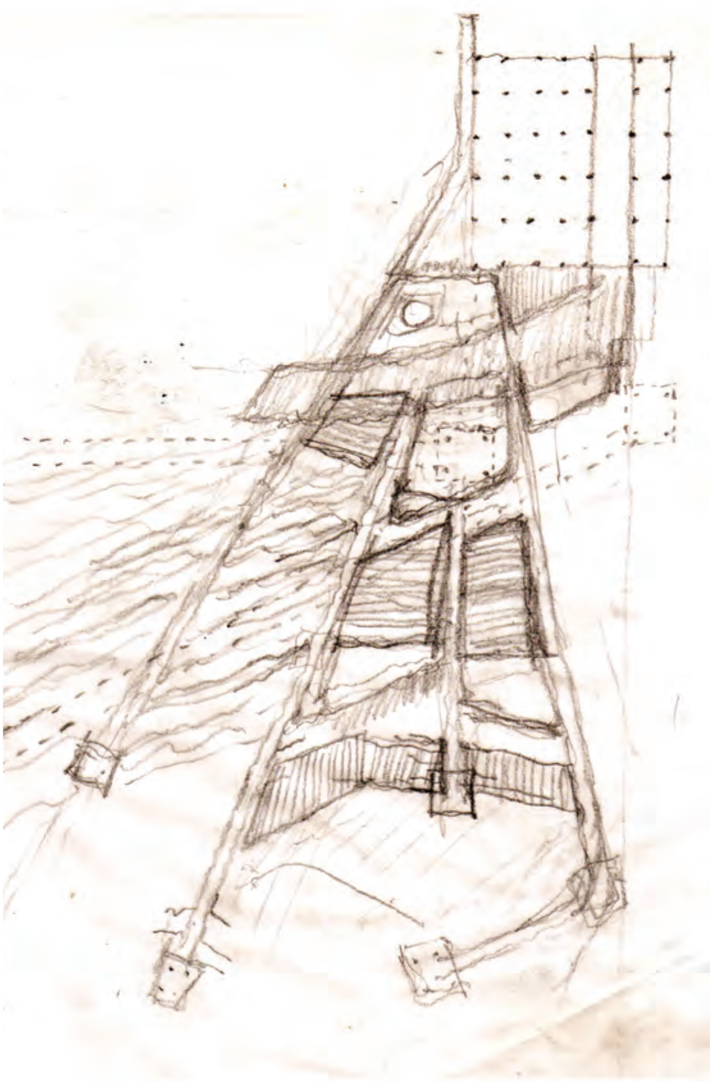
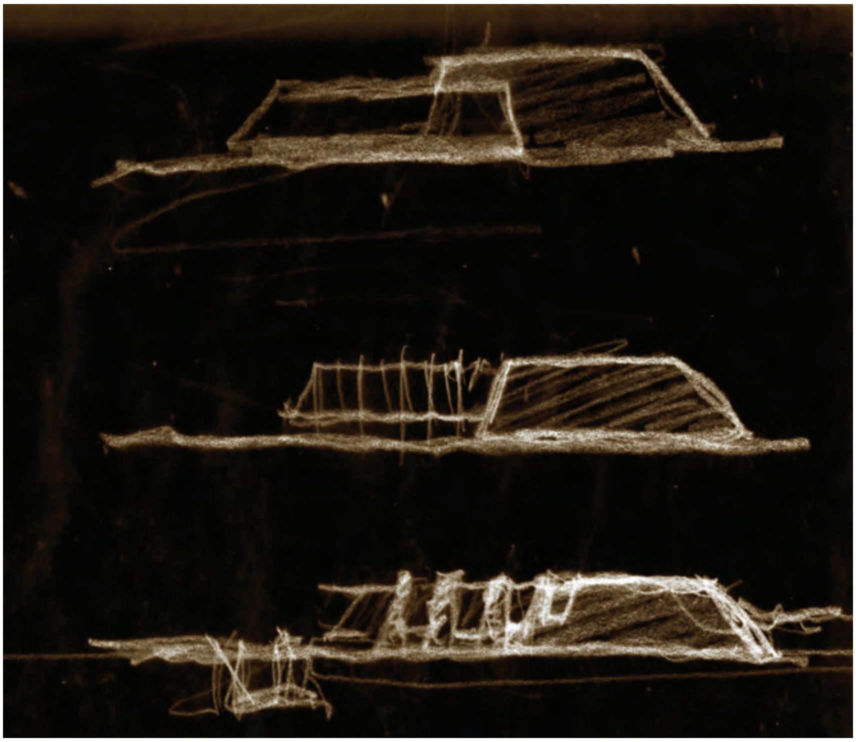


Figure 6.22. (left) Plan exploration 5 (Author 2014).

Figure 6.23. (right) Plan exploration 6 (Author 2014).



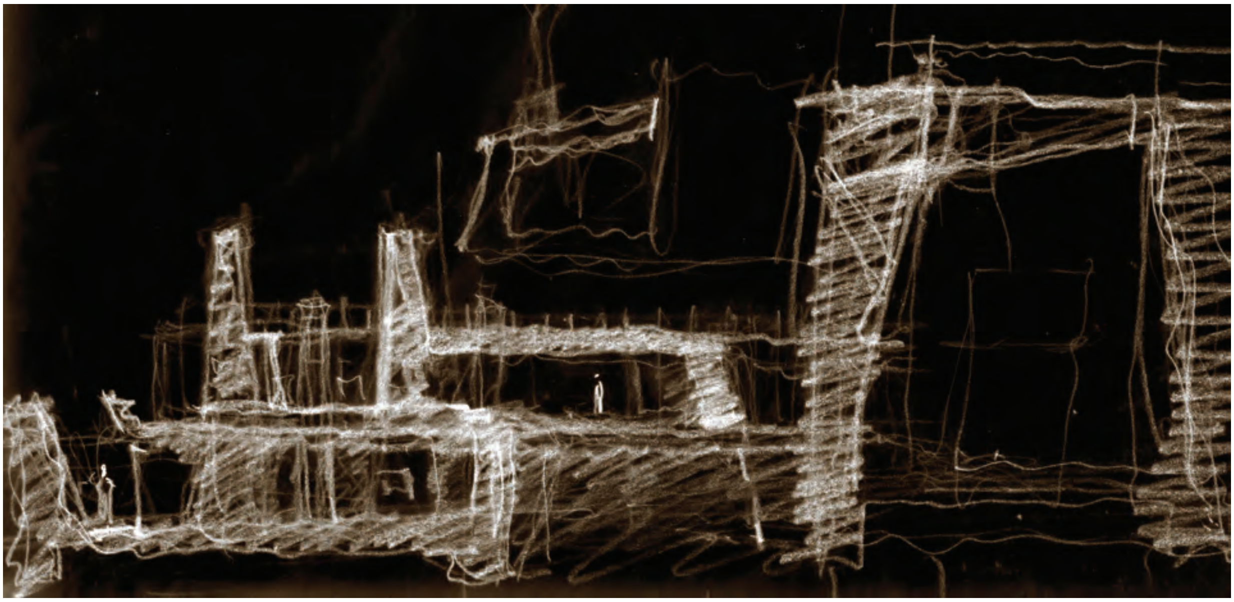
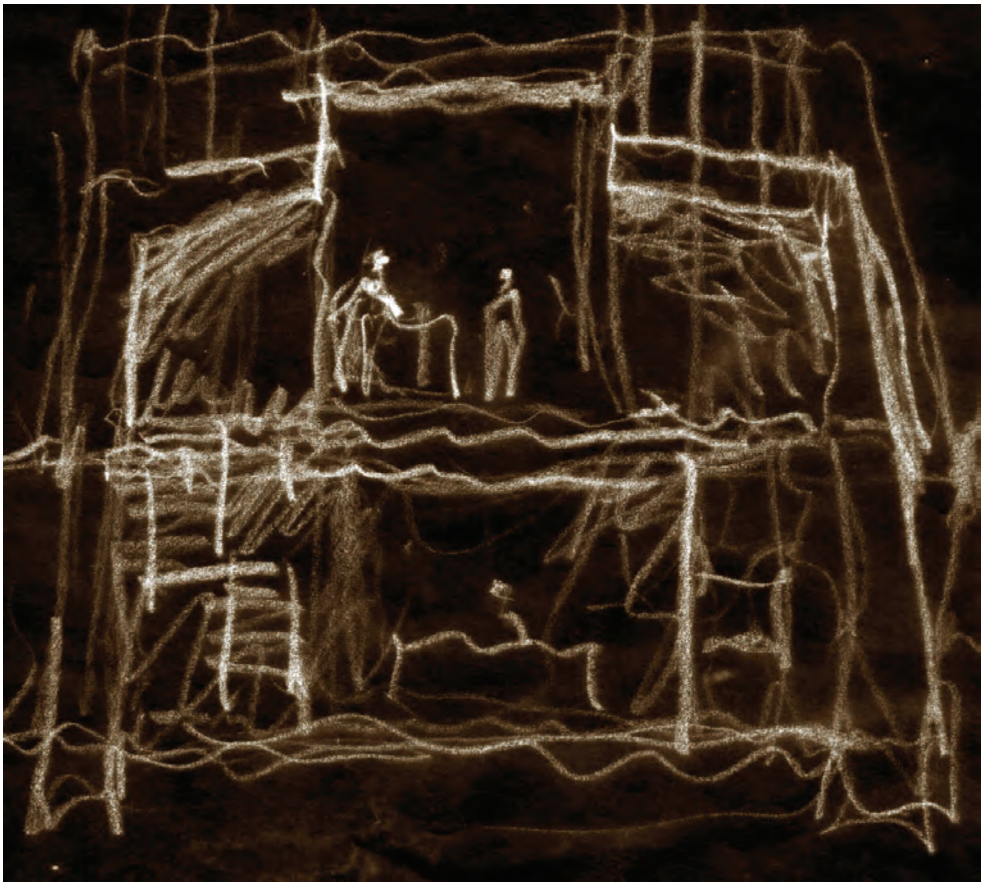


Figure 6.24. (top) Sectional exploration 1 (Author 2014).

Figure 6.25. (bottom) Sectional exploration 2 (Author 2014).



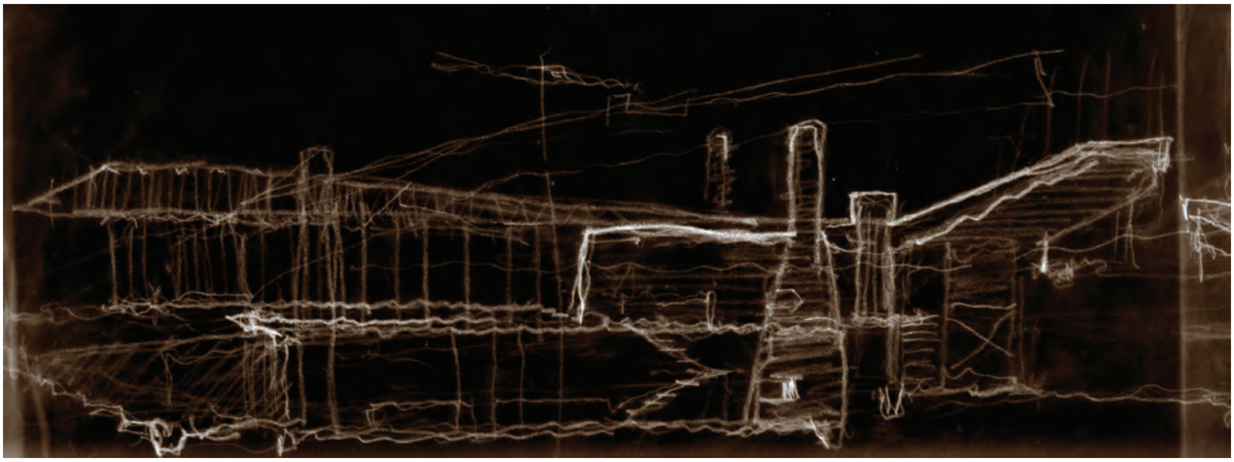


Figure 6.26. (top) Sectional exploration 3 (Author 2014).

Figure 6.27. (bottom) Sectional exploration 4 (Author 2014).

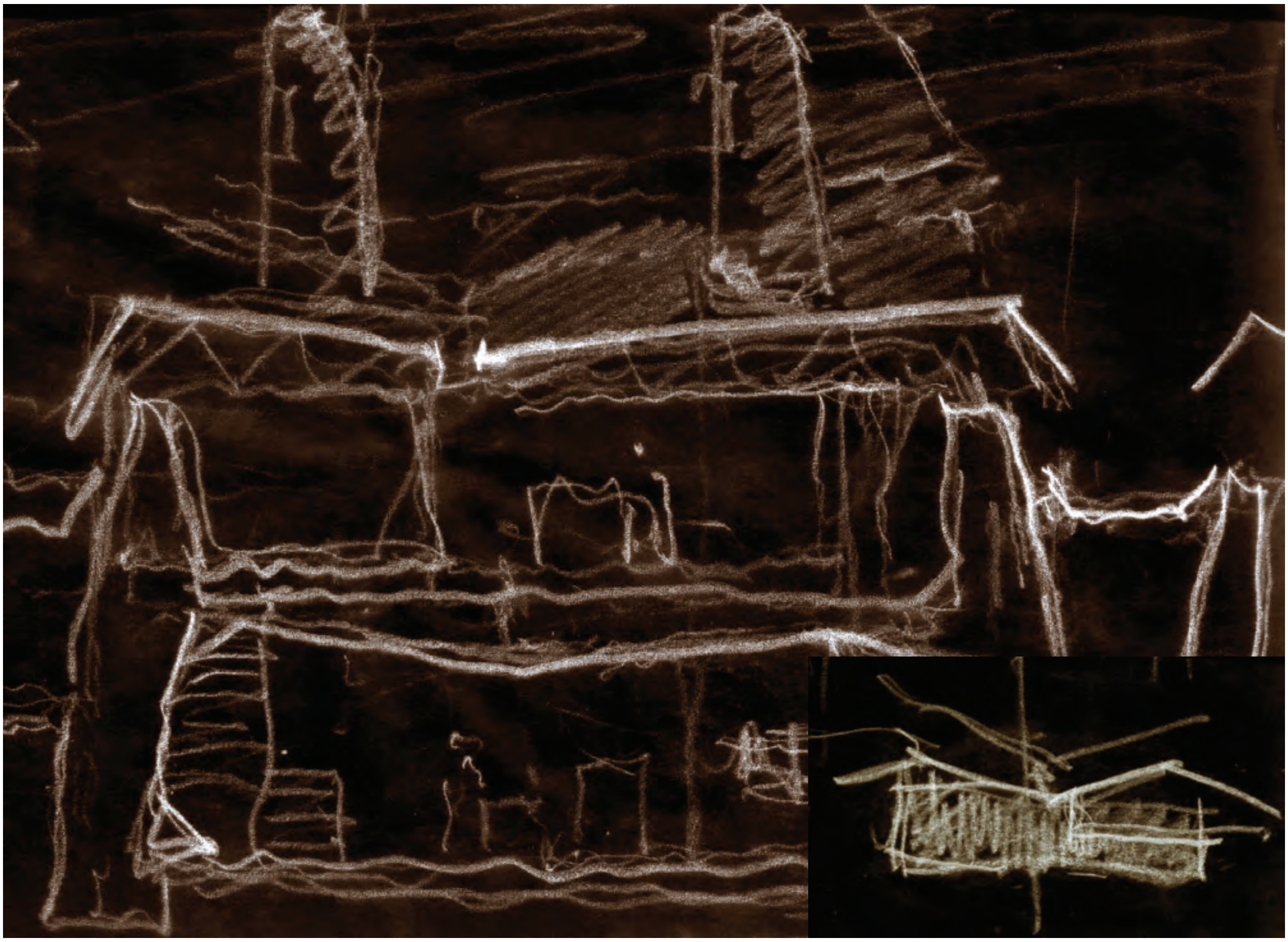


Figure 6.28. (top) Sectional exploration 5 (Author 2014).

Figure 6.29. (bottom) Sectional exploration 6 (Author 2014).

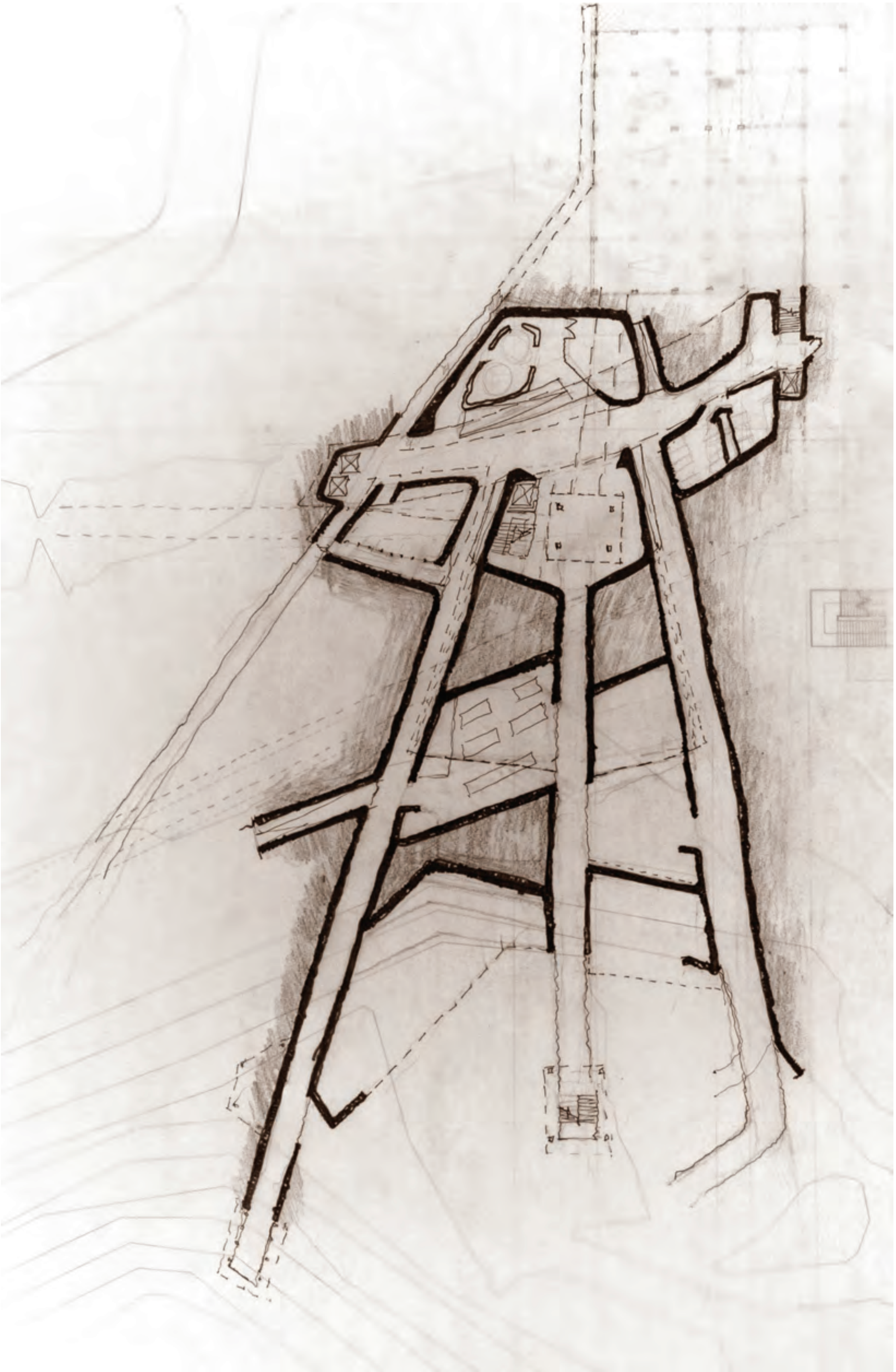


Figure 6.30. Lower ground level plan just before concept development feedback, North is up (Author 2014).

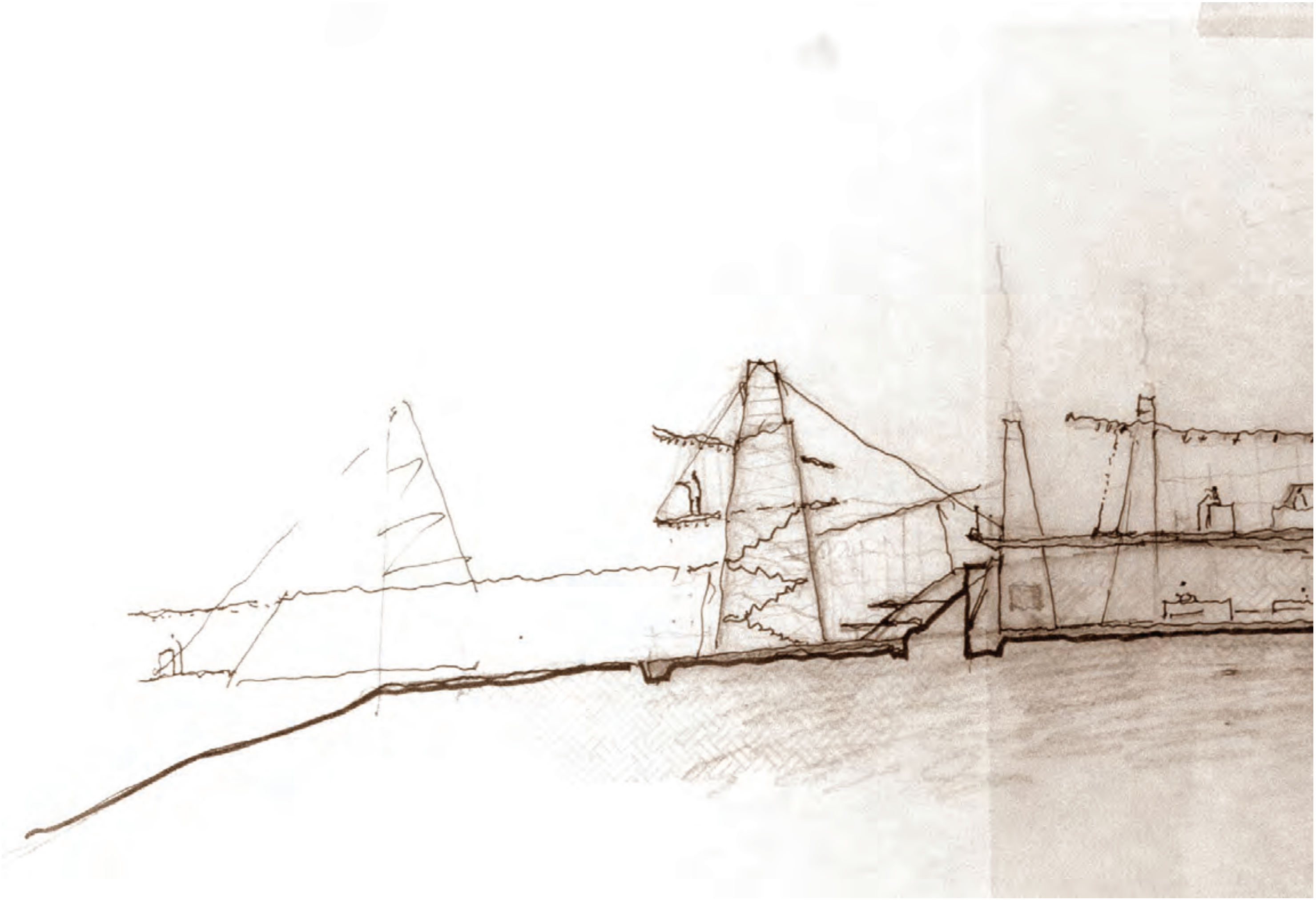
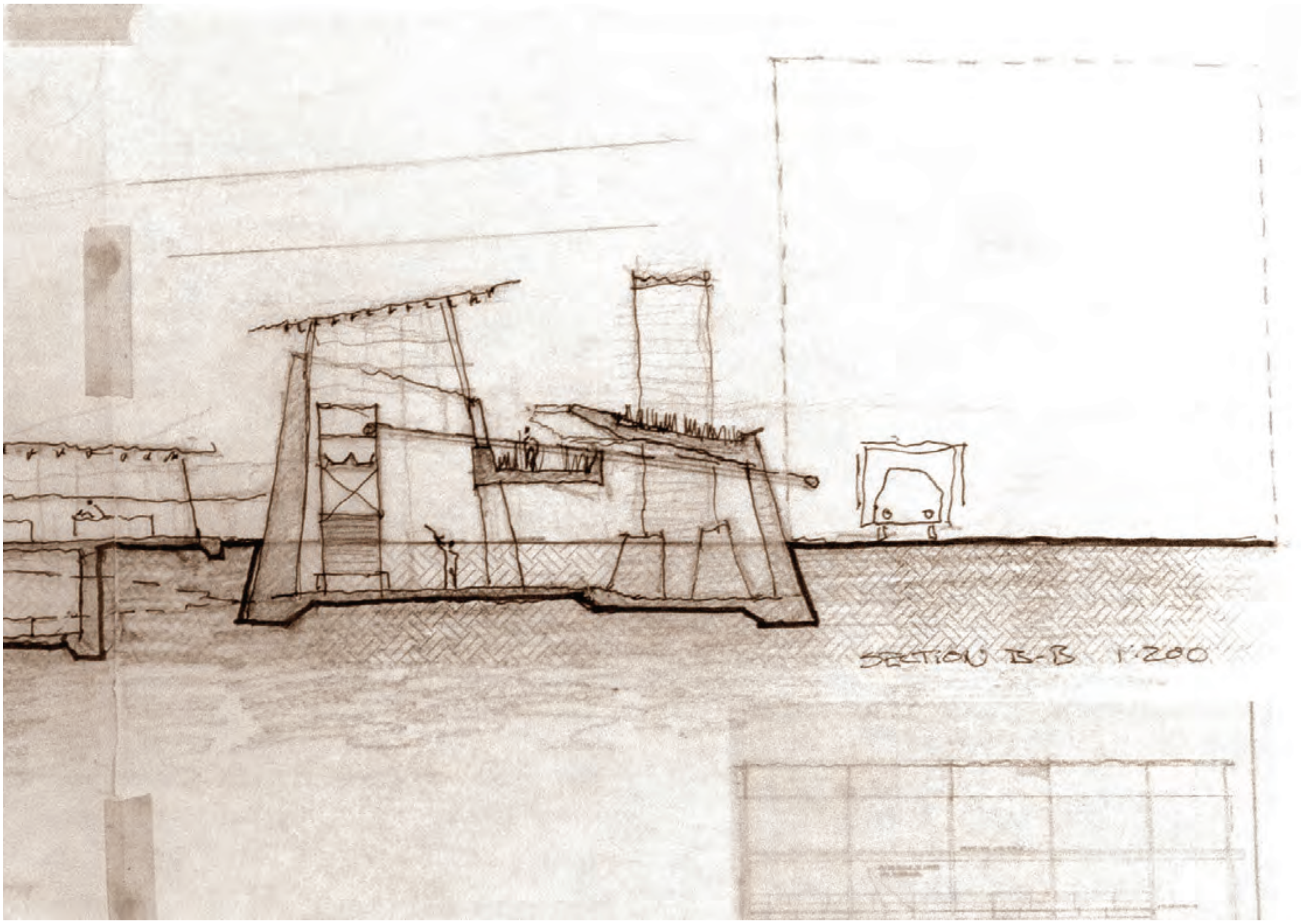


Figure 6.31. Section facing west just before concept development feedback (Author 2014).


SECTION B-B 1:200

Figures 6.32 to 6.35 show the plans and sections developed on a larger scale. Figure 6.32 shows the lower ground level for this iteration.

Space for sales and a small mill is proposed inside the existing structure of the washing plant (1). The only entrance into the new structure for the public user is through this structure down into the new building through a circulation space (2) (a section through this space is shown in Figures 6.34). This space then leads into an entrance foyer (3) with reception to the South and ablutions to the North. From here the user is lead into a double volume circulation space (5) which also contains a conveyor system and goods lifts to transport the flour and baked goods to the public kitchen (8) and the bakery kitchen (7) which both have an upper and lower level. Cold storage (4) is situated to the North of the circulation space and an administrative wing is situated to the Northwest of the kitchens. Staff enter from the service yard (9). A picnic area (10) is situated to the South of the public kitchens. It was imagined that visitors would circulate through the pathways into the landscape and also experience a link to the industrial inside the circulation space with its conveyor system. They would move through the large scale industrial building (1) (sublime of exposure) into the ground (sublime of enclosure), and explore the landscape (sublime of exposure) via different paths through the building.

This iteration of the design was presented in the first design presentation. One of the main issues in the feedback was that design decisions made in terms of building form seemed arbitrary. It was not clear as to why the pathways lead into the directions they did, but that might have been because this was not properly presented. The examiners stated that they would have preferred an intervention based on the rational grid of the existing building. I did not agree with this. If a new way of form generation is to be explored with this intervention, it surely should have a different form than the existing. This piece of feedback was taken into consideration though, as it is associated with the next piece of feedback.

The issue of the new intervention not having a definite relationship with the existing was brought up. I decided to consider these comments in the next iteration, and look into how the existing building, the new building and the landscape can relate to the theory, thereby having a better connection between the old and new (discussed in the next part of the chapter).

Another comment was that the building is too complex in terms of number of spaces, especially circulation spaces. It was also pointed out that the office space is not needed within the program. The fact that users and staff might get into each other's way and that the conveyor system might pose dangers to the public was mentioned. The roof construction also seemed too complicated and expensive. I agreed with all of these comments, and responded to them in the part 6.6 of this chapter.

Figure 6.32. (opposite) Lower ground plan development at first design presentation, North is up (Author 2014).

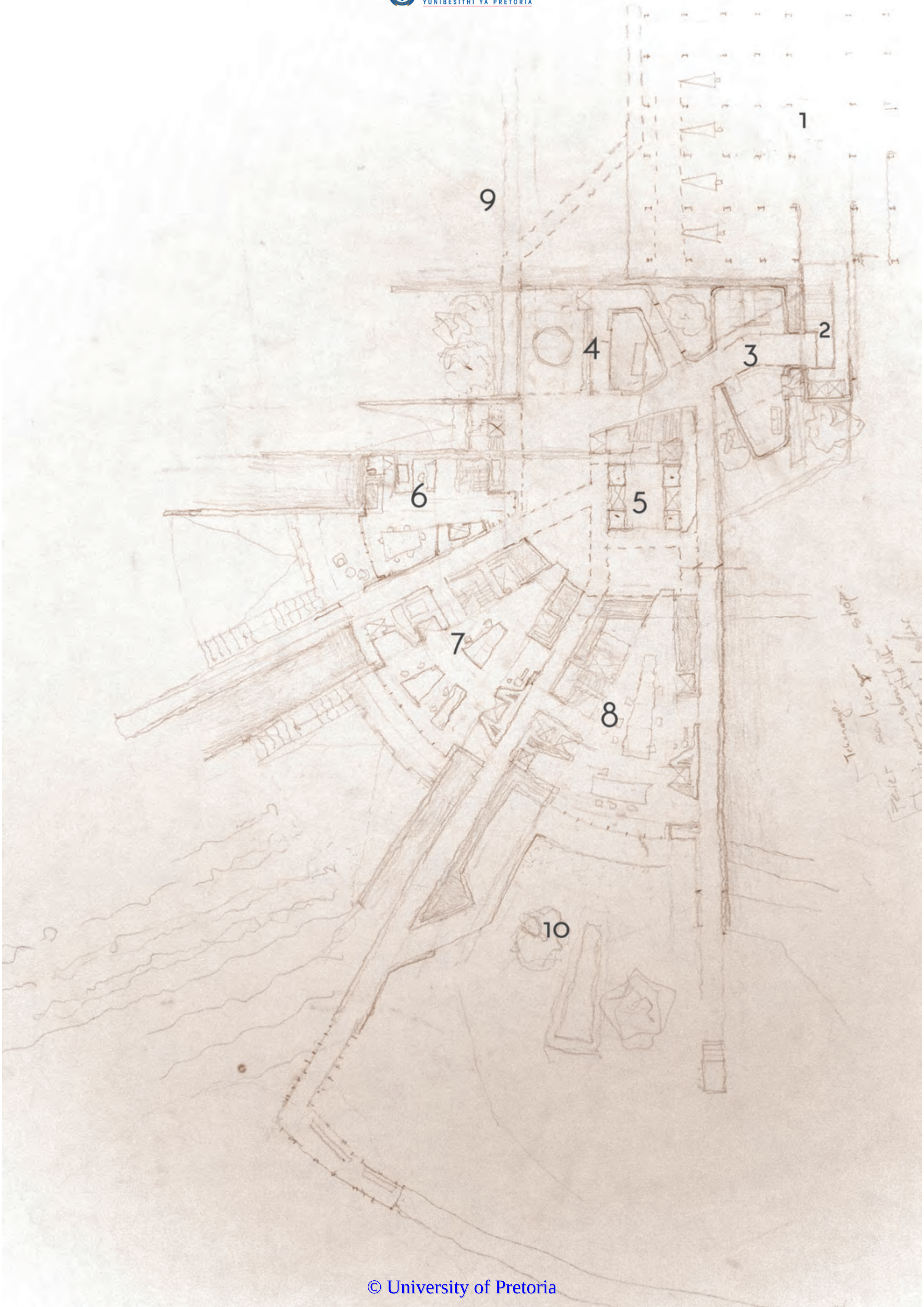

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Figure 6.33: Upper ground plan development at first design presentation. North is up (Author 2014)

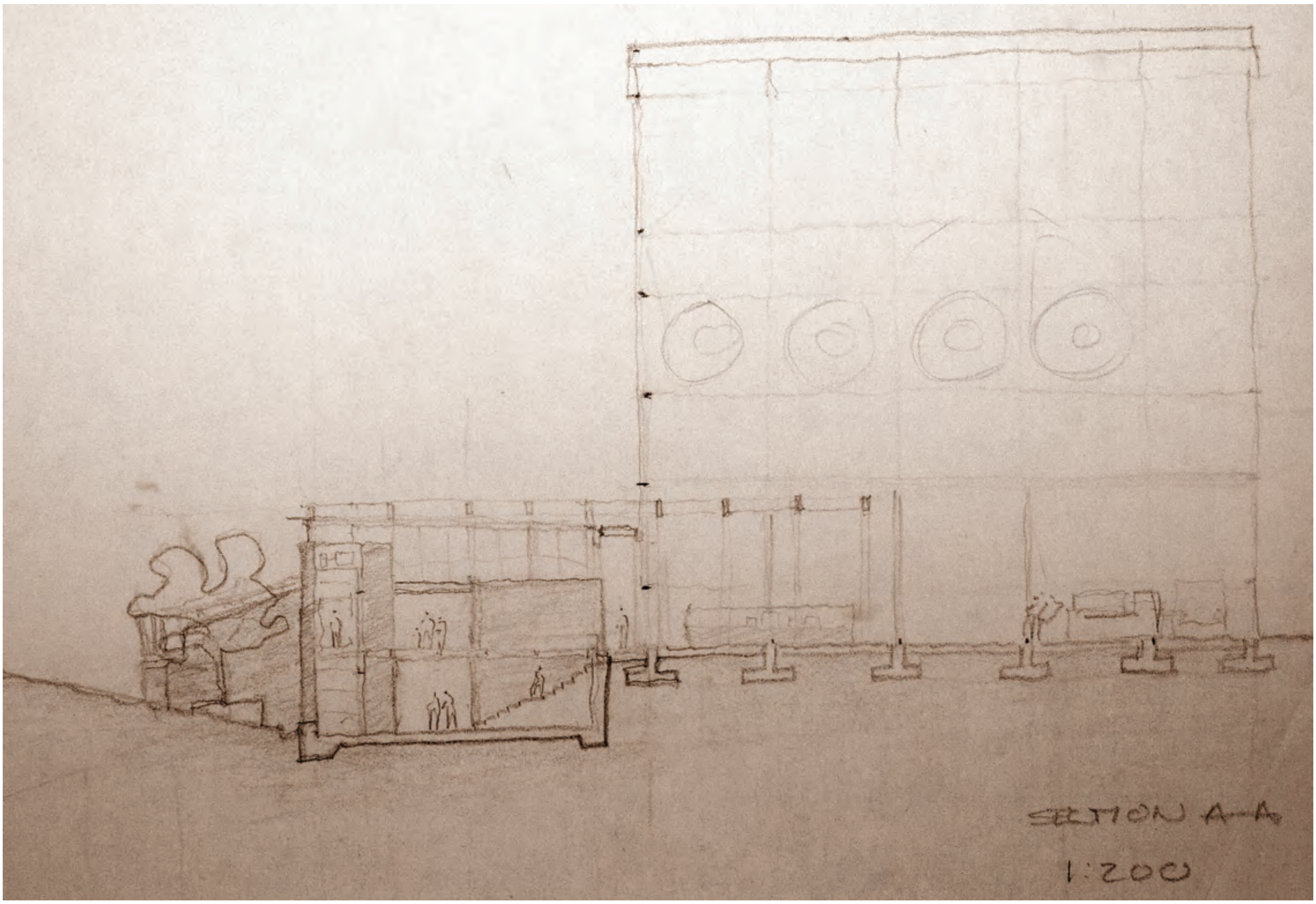


Figure 6.34. Section through entrance into new building at first design presentation (Author 2014).

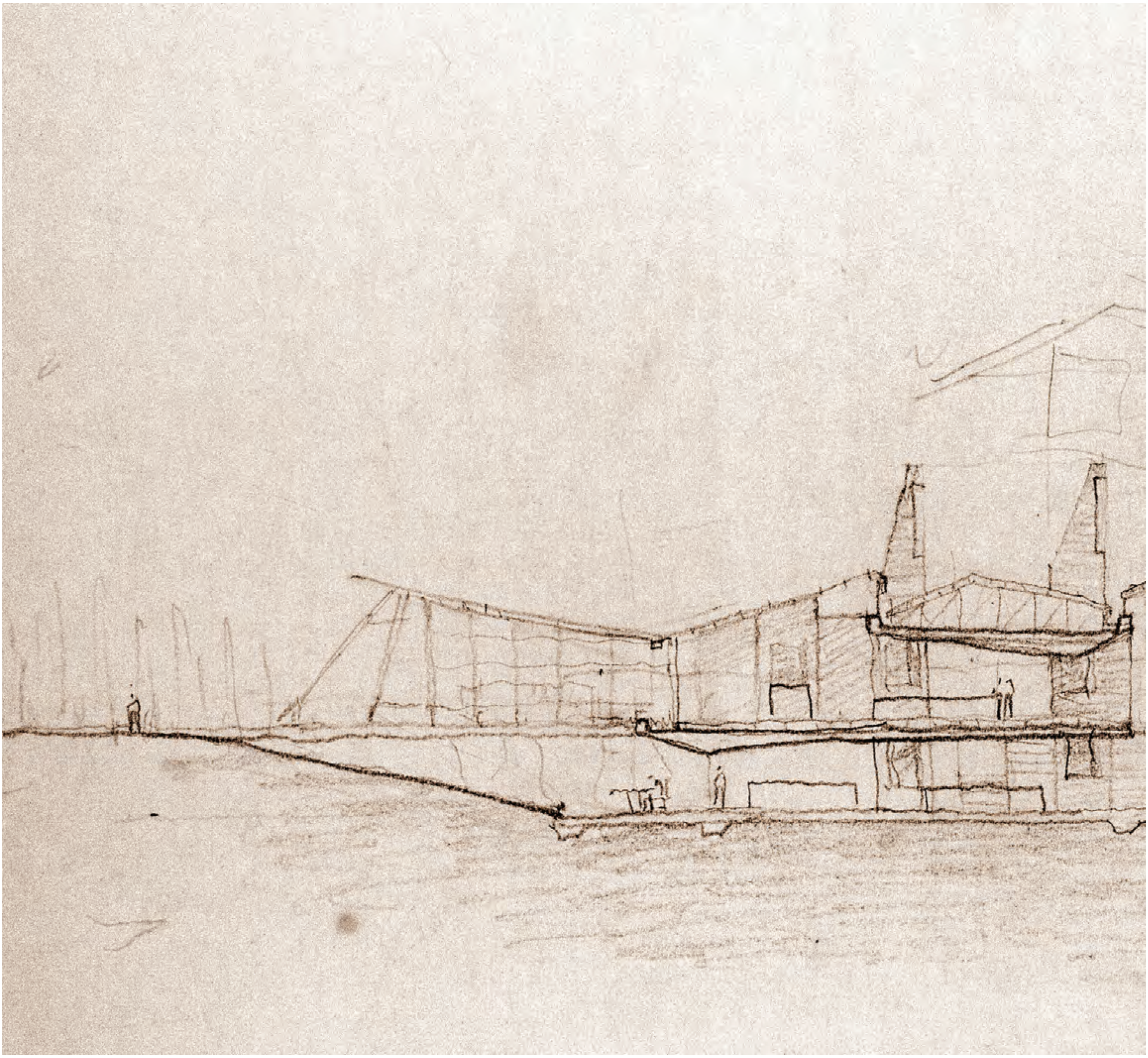
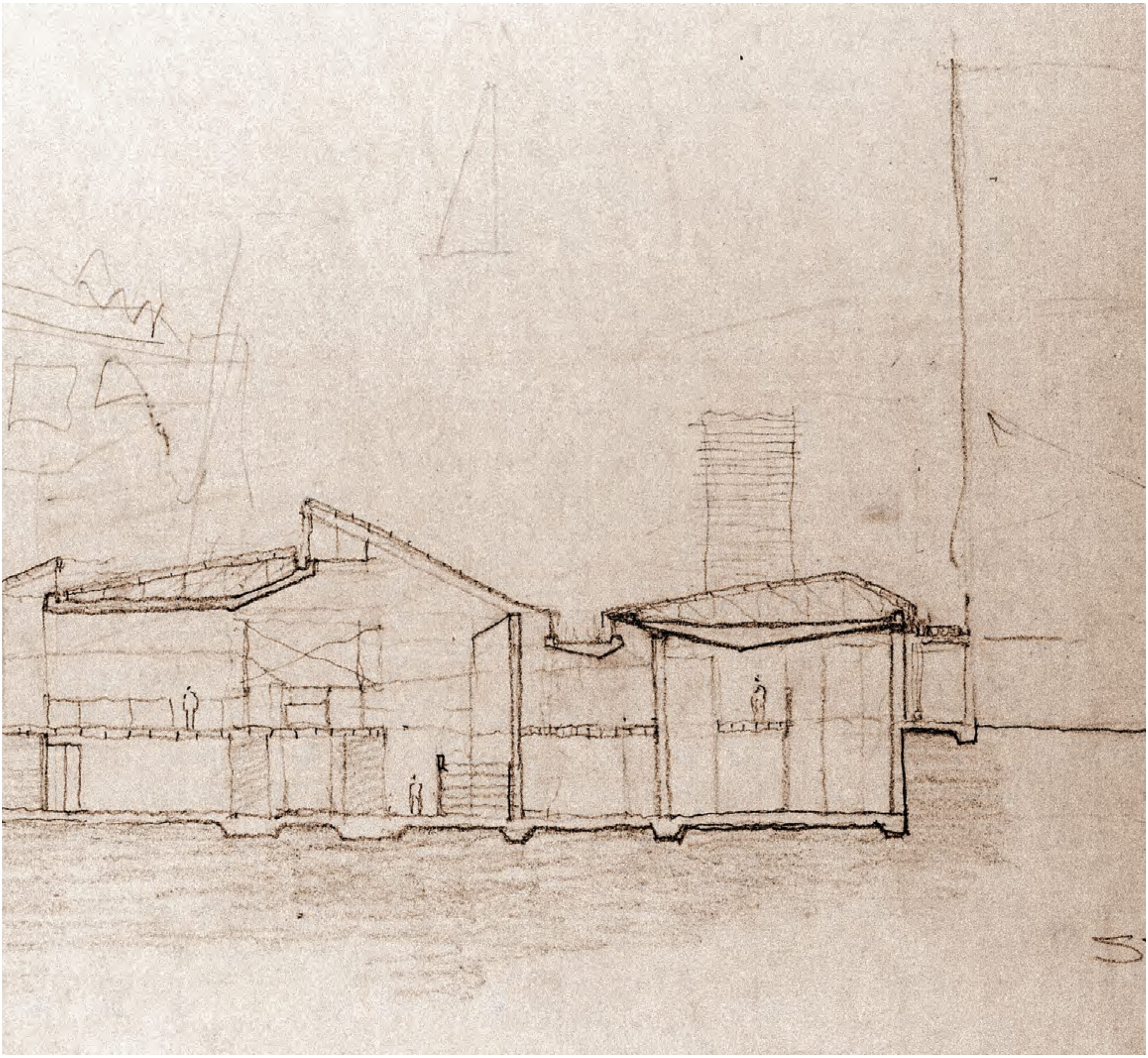


Figure 6.35. Section facing West at first design presentation (Author 2014).



Although both of these iterations were quite literal interpretations of the explorations done, some interesting things could be seen in almost all of the explorations. The first is that a physical connection is made by the new structure into the landscape around the existing structures, using specific elements on and around the site (Figure 6.36), focussing the user's attention to these elements when they emerge into the landscape.

These connections take on the forms of pathways (Figure 6.37) and serve three purposes. They articulate the forms of spaces used by the staff in the fulfilment of the program. They serve as different routes a user can take in the exploration of the building as a ruin in the landscape (the significance of the ruin will be discussed next). They also compress the space around the user before they are exposed to the vast landscape, intensifying the emotions created through the sublime, a concept that was evident in other iterations in the form of the contrast between exposure and enclosure. I also realised that these arms could be used in the stabilising of the layering in the Kimberlite reservoir in the form of water drainage ducts (discussed further in the technical development) and retaining walls.

The section diagrams and developed sections also show a roof form, which undulates over the landscape, in some iterations from North to South (as well as in the developed section), and in some from East to West (Figures 6.27 to 6.29). The feedback on the developed section was that the roof was too complex, but this was as much result of the complex arrangement of spaces on plan (feedback that has already been mentioned), as it was a result of the complexity of the structure. Both of these issues were addressed in the next iteration, but the important thing to note is the form that emerged through the exploration. An undulating roof that stems from the existing structure and dissolves into the landscape.

The feedback and the important elements that arose in these explorations will be discussed further in part 6.6 of this chapter.

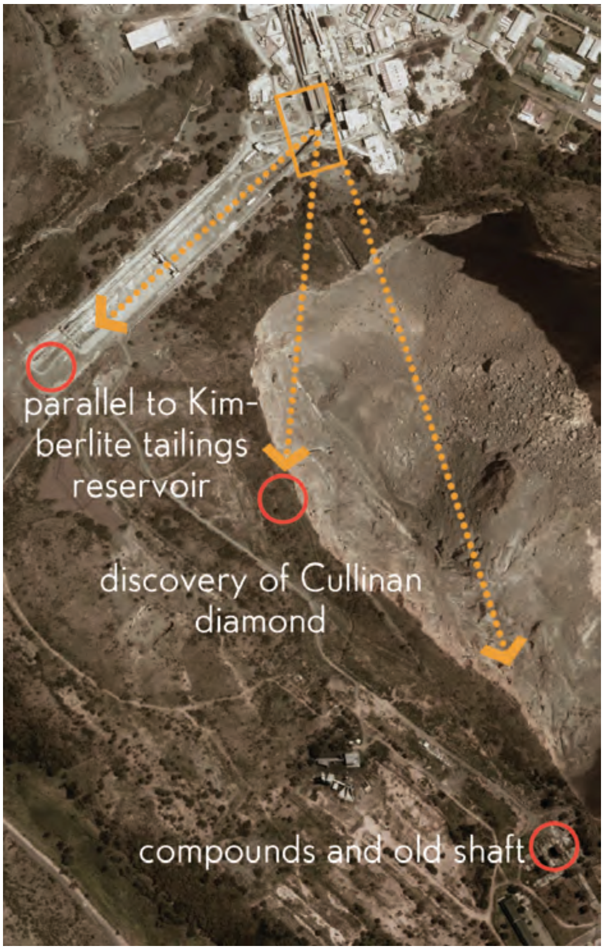


Figure 6.36. Diagram showing how pathways that emerged in design process links with landscape elements (Author 2014).

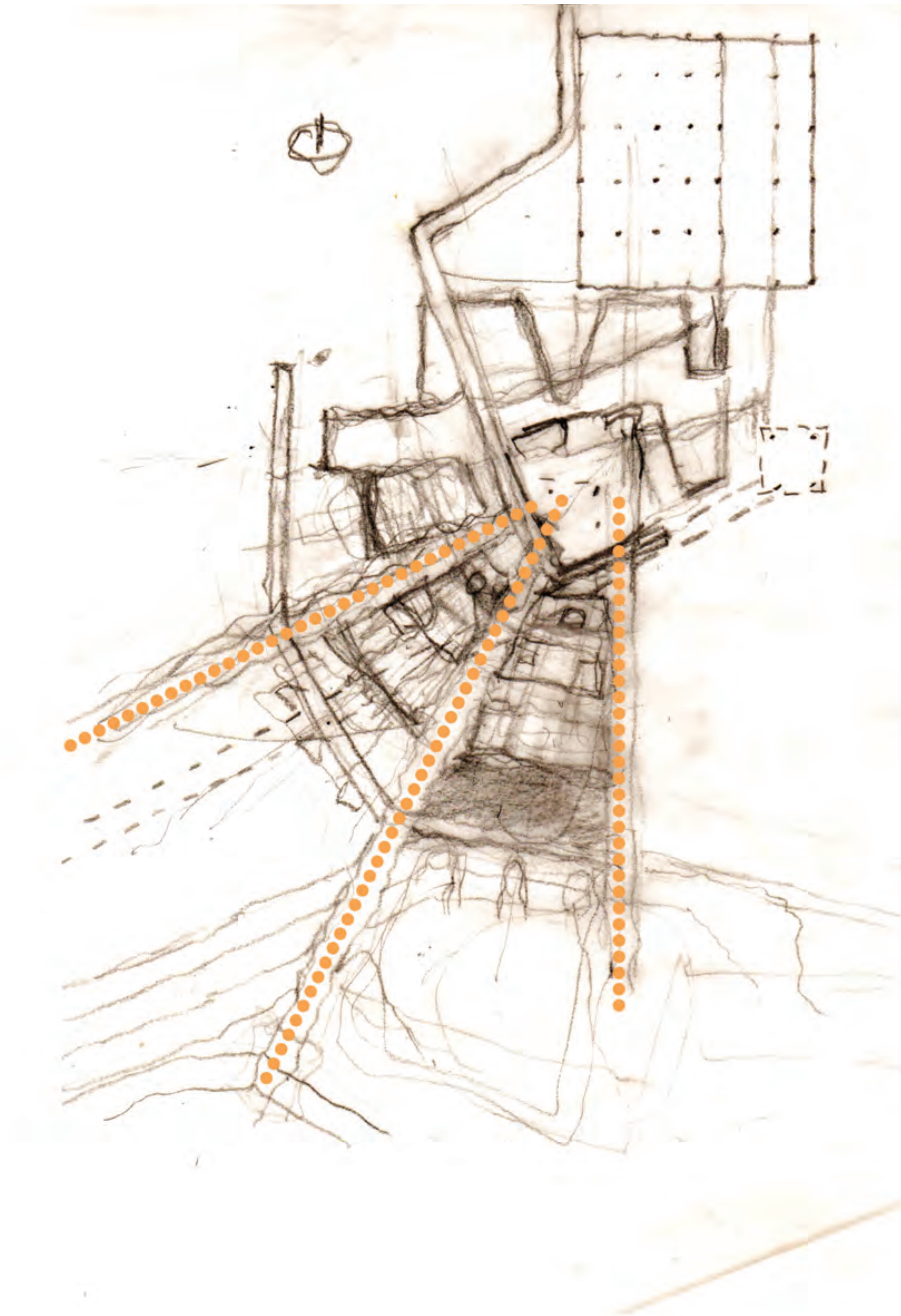


Figure 6.37. A plan development diagram with pathways highlighted (Author 2014).

6.5 Piranesi, the ruin and heritage

'Yet, human existence is meaningless if tir is not open to its own mortality.' (Mackeith 2006: 20)

It was clear from feedback that I had received in the first design presentation that I needed to establish a better link between the existing industrial structure and the new intervention. Since the new intervention was grounded in Romantic theory, I considered how this theory could be used to generate this link between the industrial heritage and the new intervention in the next iteration. For this I considered the etchings of Giovanni Battista Piranesi, an important precursor to the Romantic Movement.

Penny (1978: 5) refers to Piranesi creating 'theatrical' architecture and reconstructions of ancient heritage that, because they were not documentations, were not mechanical (rational), but rather sublime creations.

Ruins were representations of the imaginative in the public's mind. They triggered flights of fancy into a long forgotten world. They were also an outlet for the frustrated architect's imagination and a means to seduce (through their sublime nature) potential patrons.

The emphasis on seduction of the patron (the user) is perhaps what inspired Piranesi to produce etchings in which the spaces where immense (Figure 6.38) and had a vast, almost mechanical complexity (Figure 6.39). These aspects of his work could certainly be seen as a method of using the elements associated with the sublime (complexity, scale and decay) to evoke an emotional response and thereby a link between the patron (the user) and the space, as had been described by Kant (Chapter 4).

We can see the use of mechanical complexity in a space as theatrical setting in the design of the Bloomsbury pie shop by Frances Taylor, Ian Laurence and Karl Normanton (Figures 6.40 to 6.42). Here it is imagined mechanical devices such as the oven stack and a conveyor system work in conjunction with the staff in a choreographed performance to evoke emotions in the user, not necessarily associated with the rational (RIBA 2005). These devices, together with images of the scheme could be seen as similar to the methods employed by Piranesi in his etchings, to link the user with the design.

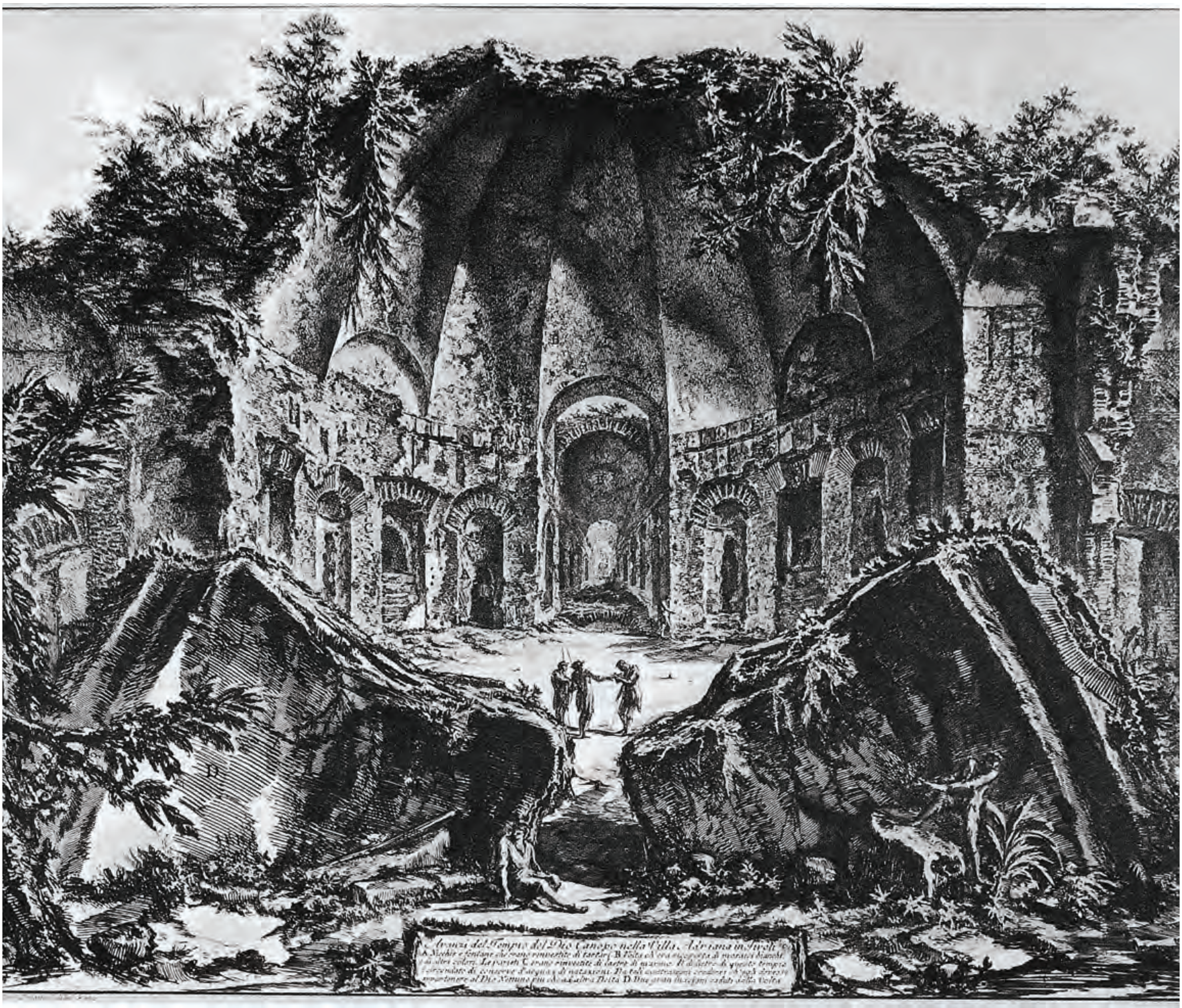
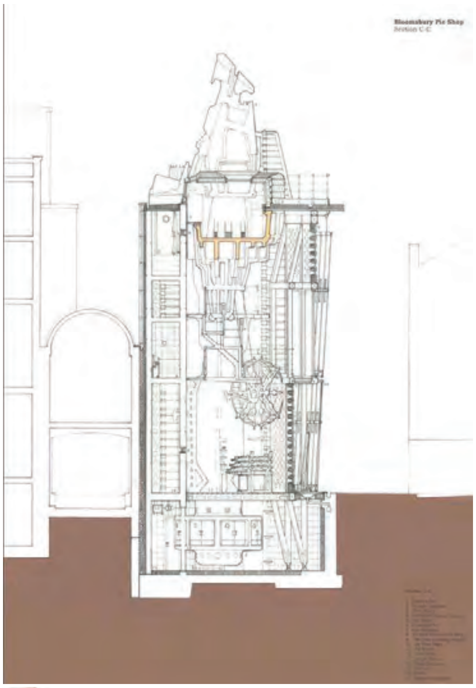
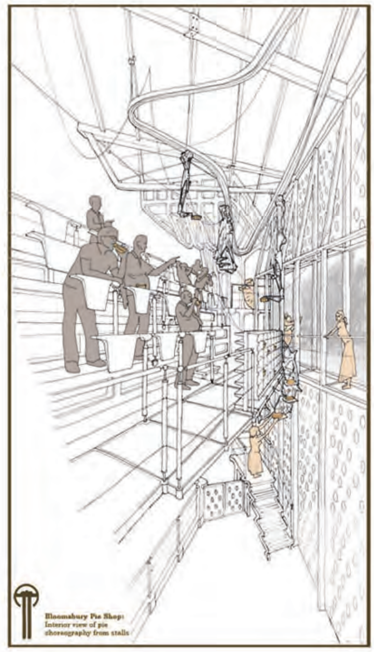


Figure 6.38. Vedute di Roma: Hadrian's Villa, the Canopus. Etching by Piranesi (Penny 1978: 76).

Figure 6.39. Carceri d'invenzione, plate 8 of revised edition. Etching by Piranesi (Penny 1978: 55).

Figure 6.40. (opposite top left) Bloomsbury pie shop cross section (RIBA 2005).





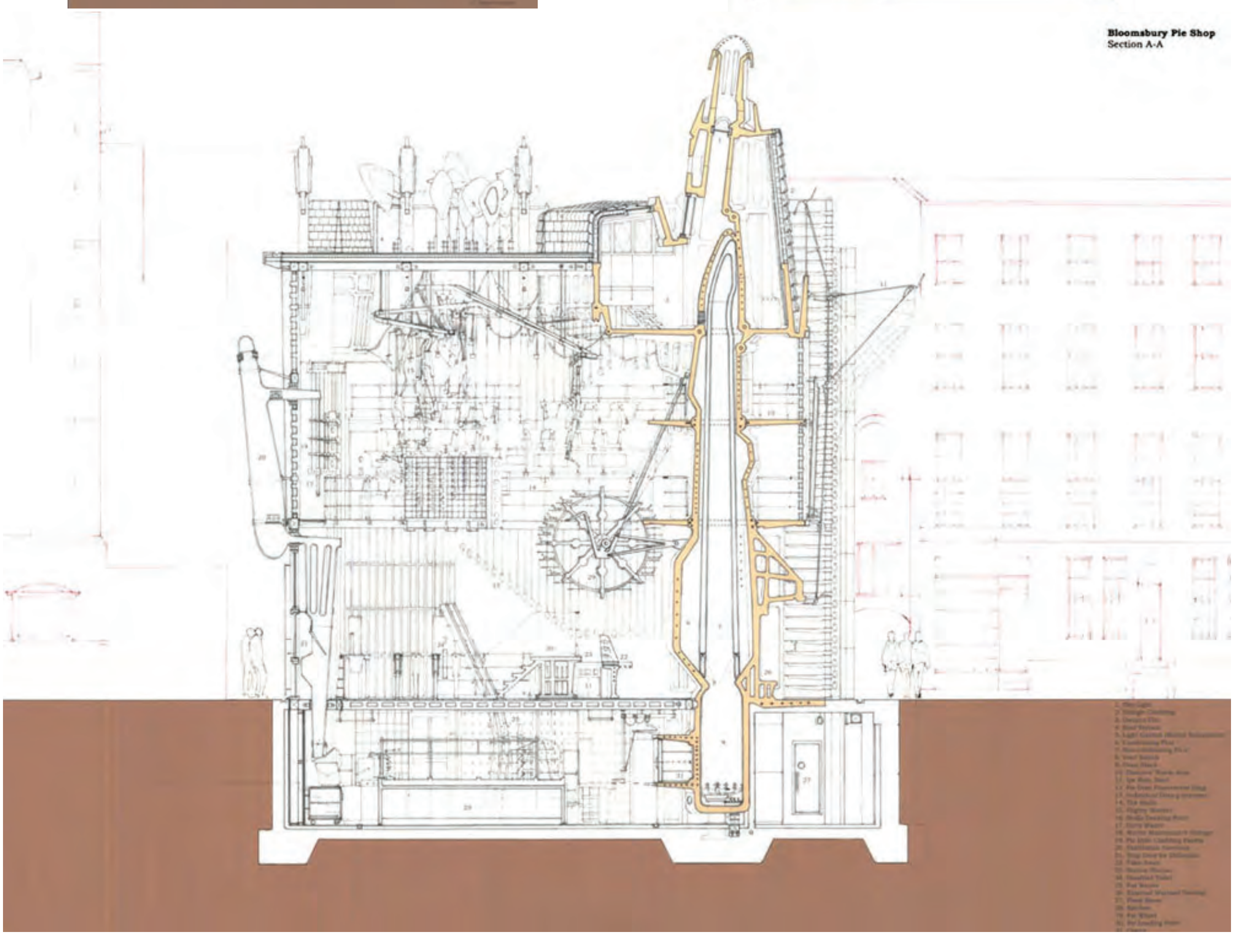


Figure 6.41. (top right) Bloomsbury pie shop mechanical theatre (RIBA 2005).

Figure 6.42. (bottom) Bloomsbury pie shop long section (RIBA 2005).

The occurrence of the ruin can also be seen in later work of Romantic painters such as Caspar David Friedrich (Figure 6.43). Here the return of man to nature was already an established idea. The sublime device of the ruin was perhaps a method of enhancing man's perspective of his own mortality, thereby establishing that nature is vast in both scale and longevity. The emotions possibly then established a relationship (link) between nature and man, the subject and the object.

These theories generated a new idea for the building form as threshold between the rational extant fabric and nature. If the complexity and scale of the washer building could be harnessed as sublime devices, as was done by Piranesi, the emotions evoked might establish another link between the user and the industrial heritage. A link that adds to the convention of displaying and documenting heritage value. The new intervention could also be considered as a ruin to be explored within the landscape, ultimately exposing the user the vastness and sublime nature of the site.

The implications that this has on the form of the building are that if the new intervention is seen as a ruin to be explored within the landscape, it can also be seen as a systematic decay of rational form (the extant fabric) into natural form (the intuitive more contextual form). The program housed within the building could also be seen as something to be discovered during this exploration of the ruin, something that is not necessarily completely understood by the user, but because of this, it can evoke uncertainty and evoke emotions in the user similar to those evoked in the viewing the works of Piranesi or Friedrich.

Figure 6.43. The Abbey in the Oakwood by Caspar David Friedrich (Wikipedia 2014).

6.6 Gaining control

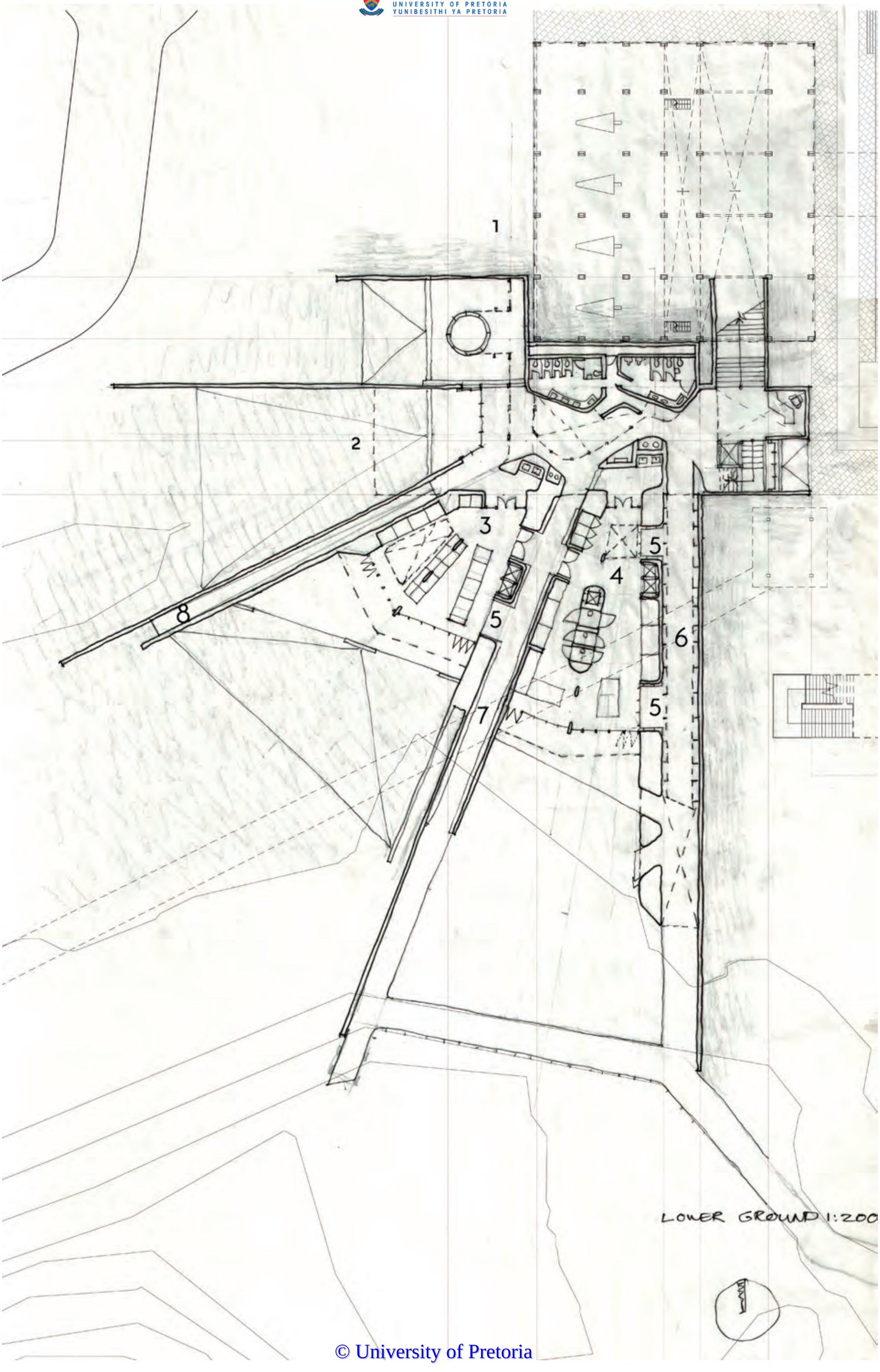
The feedback from the previous presentation, together with the above mentioned was taken into account, and a similar exercise as the one at the start of 6.4 was done. During this, I decided to use the idea of the rational grid of the existing building decaying into the landscape, together with the feedback that the circulation spaces and spaces in-between the washing plant and the new building were to numerous and complex to formulate an articulation of a new interstitial space. There would now be one public circulation space in-between the washing plant and baking spaces, with proportions based upon the rational grid of the extant fabric (Figure 6.44 to 6.47). This space is then where the rational starts to decay, with the intuitive forms articulated by the paths leading to significant elements in the landscape, puncturing into this space, guiding public circulation into these pathways.

The actual execution of the programmatic functions were also reconsidered. The complicated conveyor system to transport goods was removed. The idea of the pathways granting different experiences to the user exploring the building was combined with the sequence of the program. The developed plan in Figure 6.44 and 6.45 explain this.

Staff enter the building at a separate entrance in the service yard (1) and circulate through the building to their workspaces on a different circulation route than the visitor. The first space (2) created by the routes into the landscape would then represent the raw material, and the grain field would slope into this space. To the North of this, close to the service end of the building is a grain silo, also representing raw material. The next space between the pathways (3) would then be a space where raw materials are processed. The mixing of dough and the proofing would be done here. The final space (4) would be where the goods are baked and then packaged to be sold at the sales counter in the washing plant. Goods are transported between these spaces on goods trolleys, perpendicular to the direction that the pathways lead in. Vertical movement of the product within these spaces is done with the use of had operated goods lifts. These mechanical devices add to the complexity of the space, adding richness to the exploration of the 'ruin' as mentioned before. The program and how it operates within these spaces will be further discussed in the next chapter. Figures 6.46 and 6.47 show how the public circulates through the building and how staff and goods circulate through the building respectively.

The public pathways leading into the landscape have spaces of repose that puncture into the production spaces (5). Here the visitor can view the production process. This articulation of program then lends a distinct characteristic to each of these pathways. Visitors would have varying experiences in each of the routes they choose to use while exploring. The first route (6) speaks of containment and rational control of the landscape on one side (a massive retaining wall) and making of a product on the other. The second route (7) speaks of making on the one side and refinement of a raw product on the other. The third route speaks of refinement on the one side and raw landscape and material for production on the other (8). These routes also get progressively narrower towards the raw landscape, further emphasising their difference and echoing the concept of decay into the natural from the rational man made.

Figure 6.44. (opposite) Lower ground level plan at design development presentation (Author 2014).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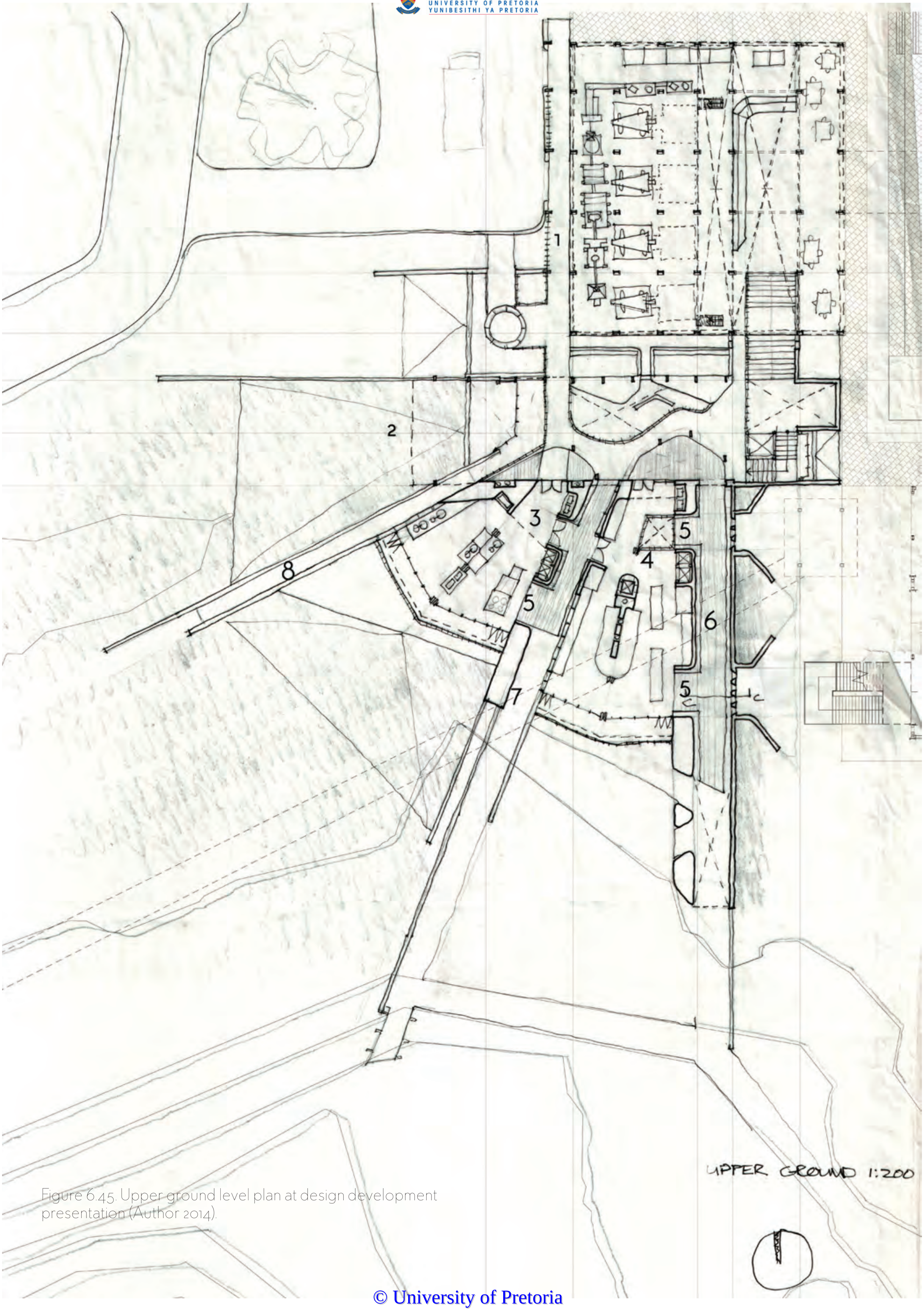
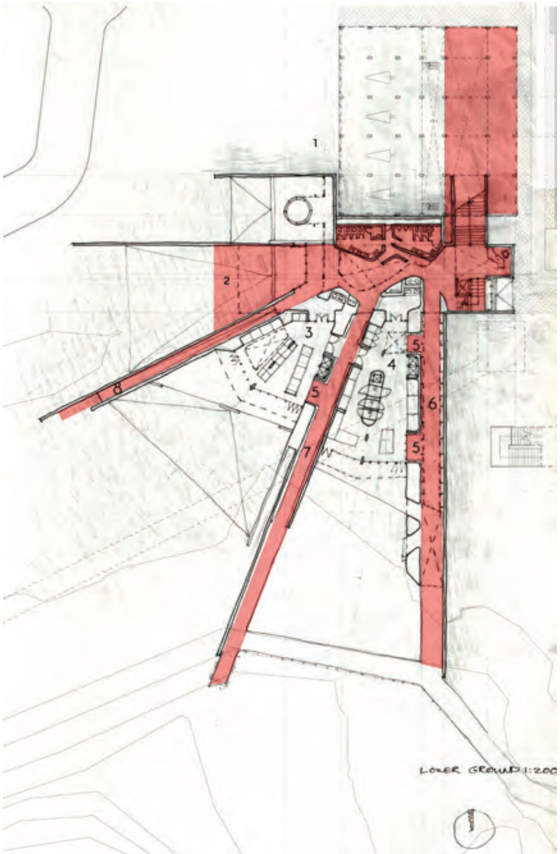


Figure 6.45. Upper ground level plan at design development presentation (Author 2014).



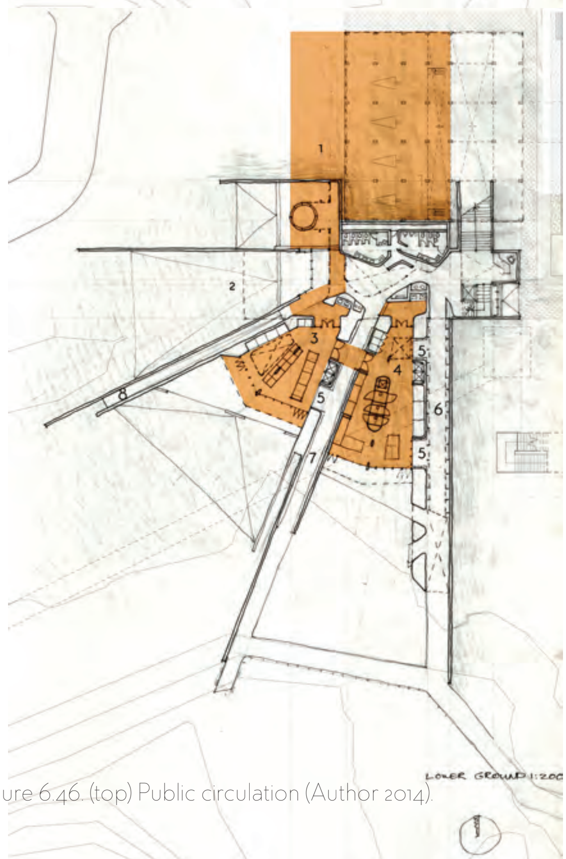


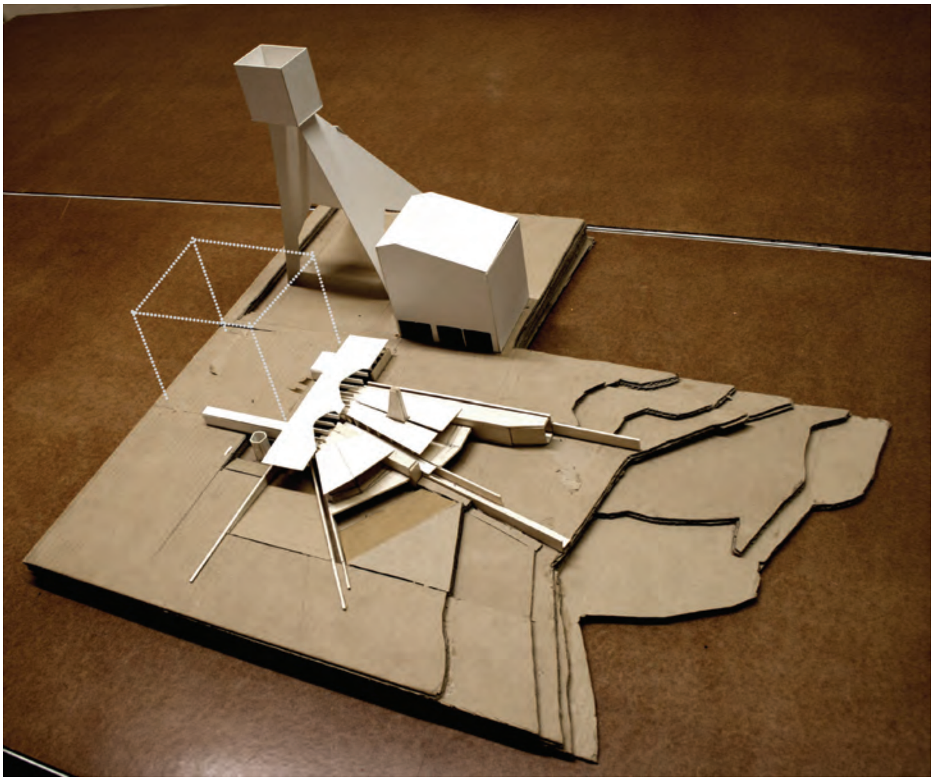
Figure 6.46. (top) Public circulation (Author 2014).

Figure 6.47. Staff circulation (Author 2014).

The model and the sections (Figures 6.48 to 6.52) show the articulation of the concept of the sublime of enclosure and the sublime of exposure. The enclosed spaces are situated on the lower ground level, built from massive materials. The spaces on the upper ground level are then enclosed with a roof folding over the landscape, from East to West, built from lightweight materials (Figure 6.50). These spaces then emphasise the sublime of exposure. A lightweight roof, based on a rectilinear grid that decays toward the South of the site, encloses the space between the washer building and the bakery.

These drawings and model were then presented in the next design presentation. The overall reception of this iteration seemed to be better than the previous one. The examiners commented that they could start to see the how the theory and concept influenced the form, but that the composition of the form and the building still had some issues. An issue was the fact that the scale of the building was that of the domestic, something that can be seen in the section. If this were to be a building where the public can meander through as a link to the landscape, then surely it should be more of a public scale. The cramped spaces were a result of trying to emphasise the sublime of enclosure, but it was pointed out that this could still be achieved through materiality and form on section.

The relationship between the new and old structures was also clearer now, although this still needed work, and was not yet clear enough. Something that was also pointed out was that the proposed ablutions were the focal point of the composition. The roofs, although lightweight in materials and construction, still read as heavy objects in the landscape.



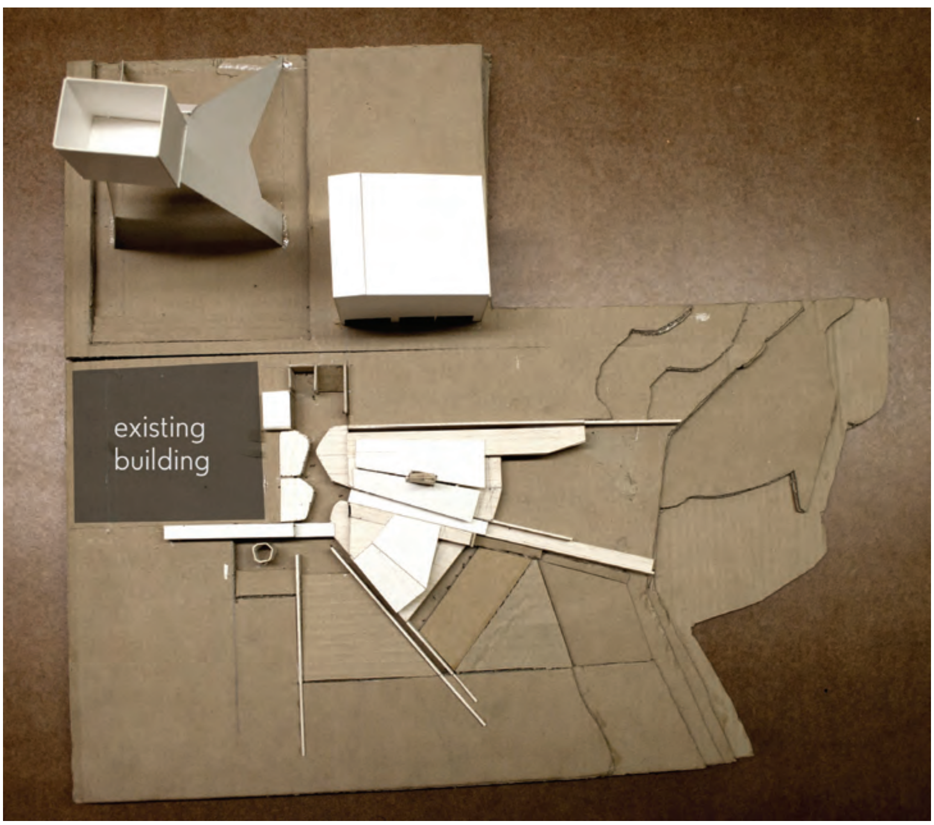
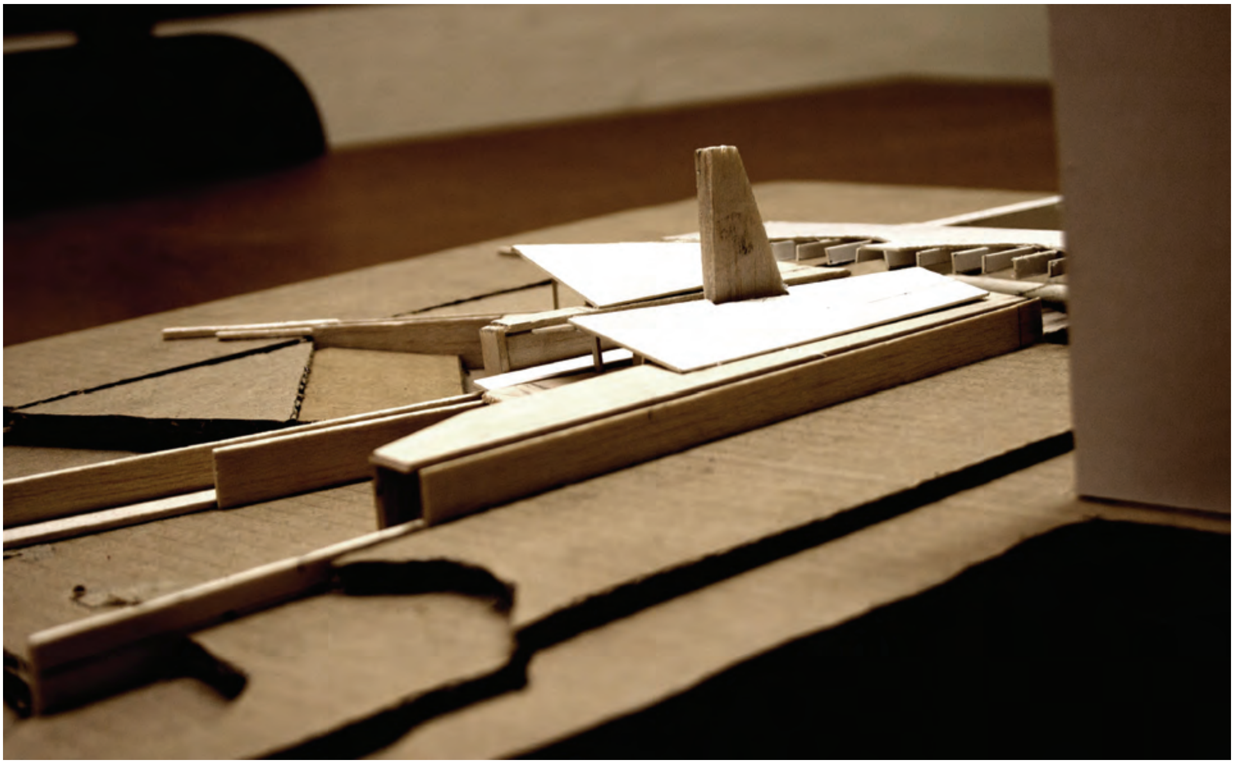


Figure 6.48. (top) Model at design development prestentation, view from Southwest (Author 2014).

Figure 6.49. (bottom) Model at design development presentation, roof over circulation hall removed (Author 2014).



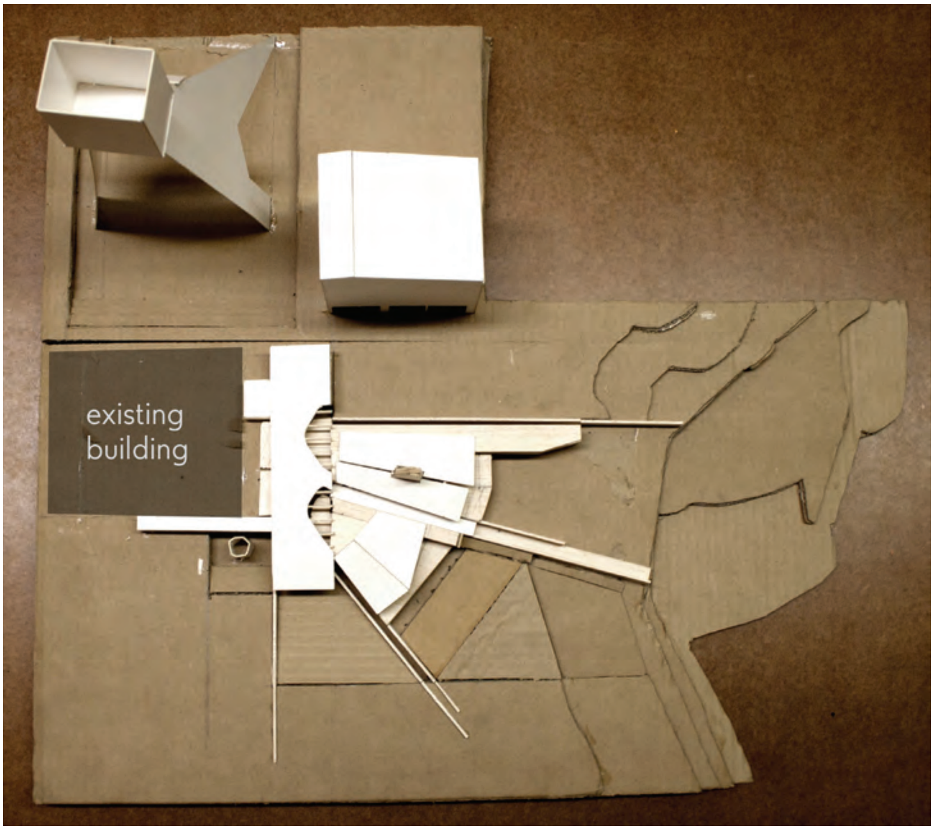


Figure 6.50. (top) Model at design development presentation, roof folding over landscape (Author 2014).

Figure 6.51. (bottom) Model at design development presentation, top view (Author 2014).

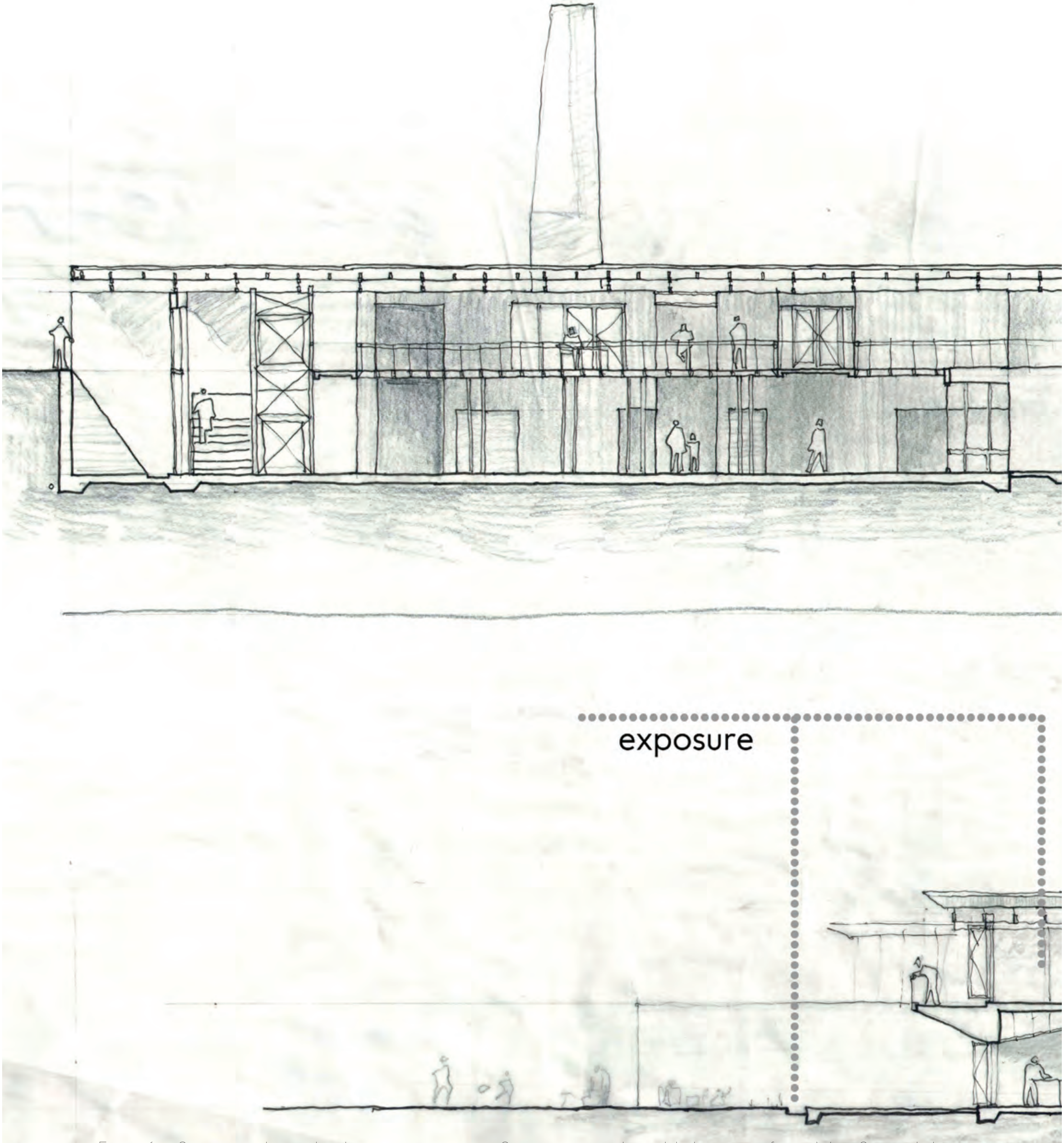
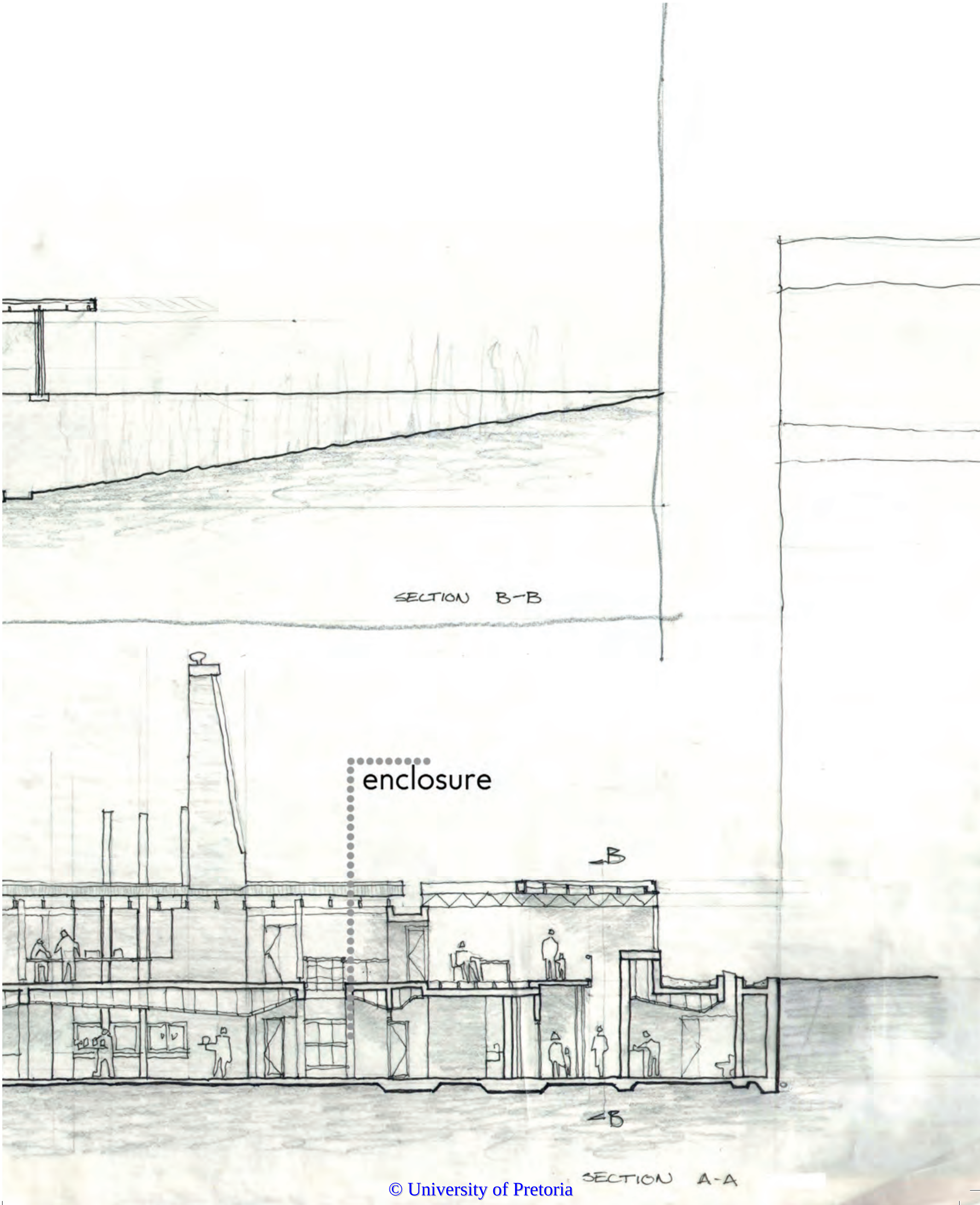


Figure 6.52. Sections at design development presentation. Section a-a cuts through baking space facing West. Section b-b cuts through circulation hall facing South (Author 2014).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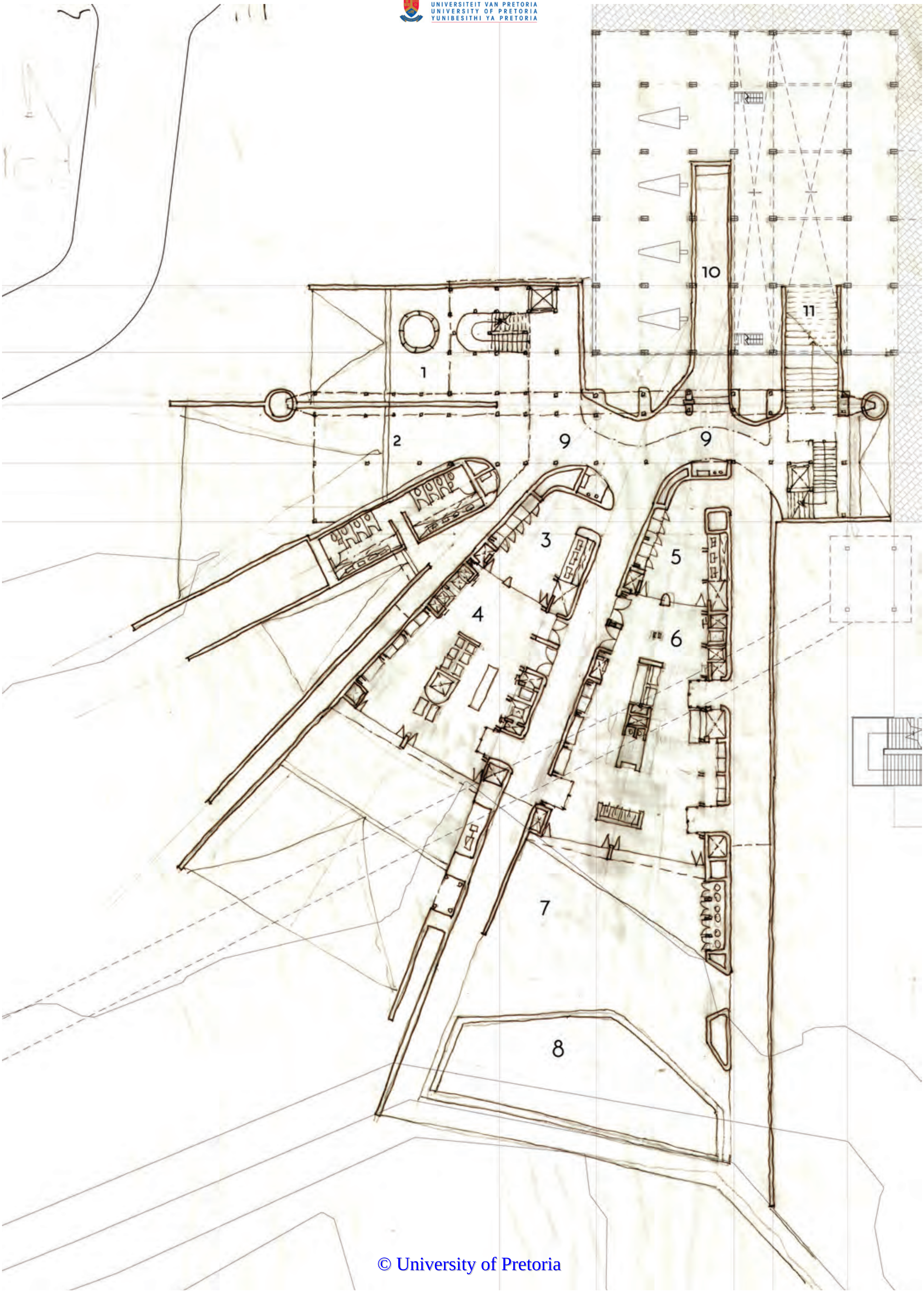
6.7 Refinement

Figures 6.53 to 6.59 show the refinement of the design after the above mentioned presentation. The issue of the building having a domestic scale was addressed by raising the ceiling heights of the spaces, so that the new levels relate to the existing levels in the washer plant (Figure 6.55). This served to make the spaces less cramped and also to create a stronger relationship between old and new.

The focal point of the composition on plan (which had previously been the ablutions) was reconsidered. This focal point was redesigned as another pathway drawing visitors from the main circulation space into a new lower level in the washing plant (Figure 6.53). Here visitors can move underneath the washing equipment, granting another perspective of their massive scale, another evocation of emotions through the sublime of exposure which links the user to industrial heritage. The ablutions were moved to the west of the new building forming part of the pathways' radial composition (Figures 6.53 and 6.54) whilst still granting views of the grain fields sloping into the structure.

The roof was also redesigned with the aim of resonating better with the concept of the new structure being a threshold that decays the rational into the landscape. As can be seen in the model that was built (Figures 6.56 to 6.59), the new roof folds out of the existing steel cladding of the washing plant and undulates over the landscape from North to South. The portion the roof form then takes on a less rational shape over the circulation space, while the column grid is still based on the rational grid of the existing building. The roof over the production spaces is now clearly separated from the heavyweight structure with a clerestory window. The glazing of this window also hides the column grid inside the space underneath the roof, creating the impression that the roof floats over these spaces. Thus we have a decay of the rational echoed in the roof form. Starting with a clear rational structure in the washing plant, it leads to a form that is not clearly rational, but still has rational structure, to a roof that floats over the newly formed landscape with a structure that is obfuscated.

This iteration was the one that was brought forth in the technical development chapter which follows. The choice of materials, articulation of details, and technical aspects of the program as well as the tectonic concept will be discussed. This chapter will also show further changes to this iteration due to the technical considerations.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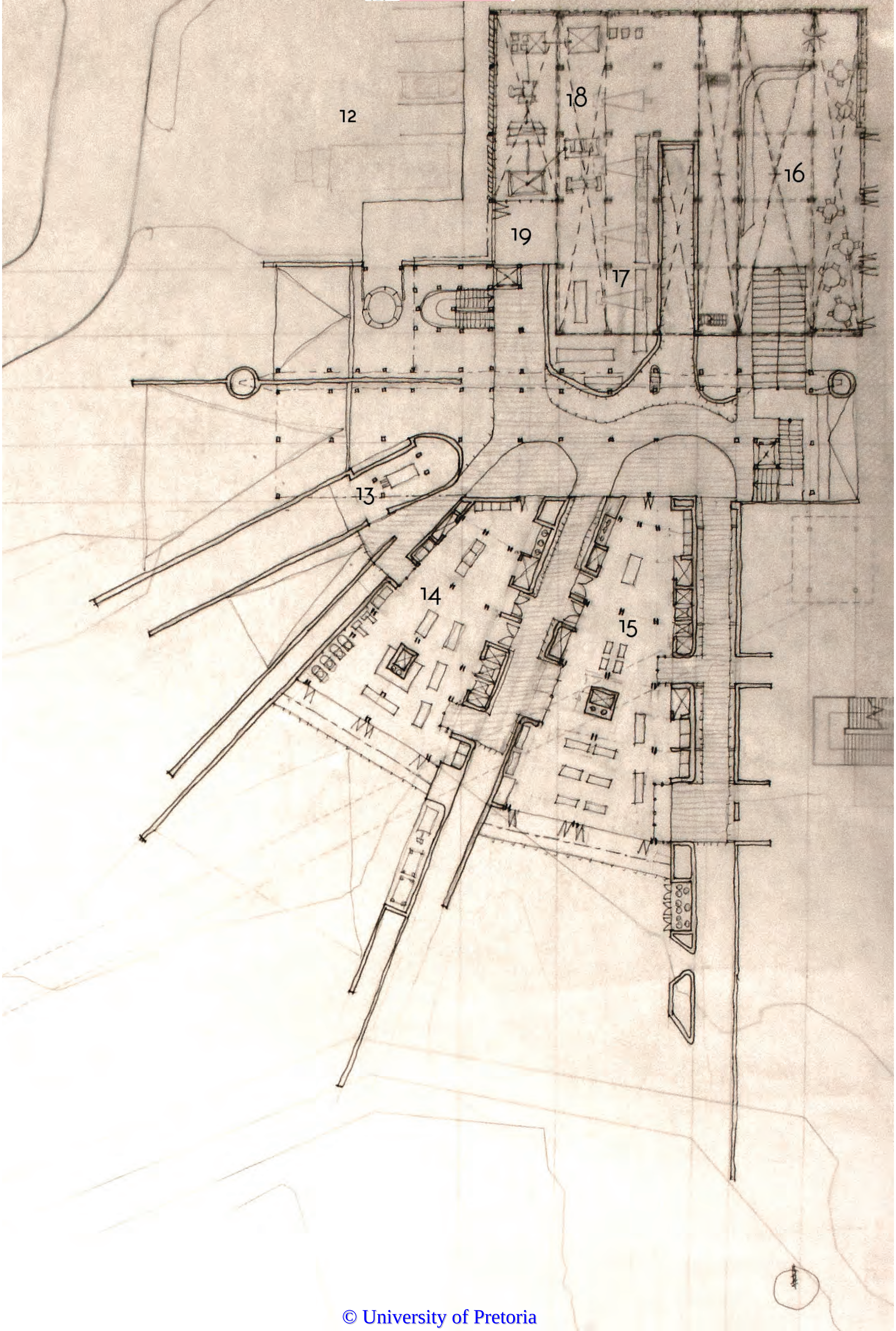
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1. Grain silo and staff circulation
2. Landscape view of raw materials
3. Staff lockers and hand wash basins
4. Proofing and fermentation space
5. Staff lockers and hand wash basins
6. Baking space
7. Picnic area
8. Water storage dam
9. Main circulation hall
10. Machinery viewing space
11. Public entrance into new building
12. Staff parking and service yard
13. Plant room
14. Mixing space
15. Packaging space
16. Sales and public interface
17. Flour storage
18. Milling macinery
19. Staff entrance

Figure 6.53. (previous page) Lower ground plan at start of technical development (Author 2014).

Figure 6.54. Upper ground plan at start of technical development (Author 2014).

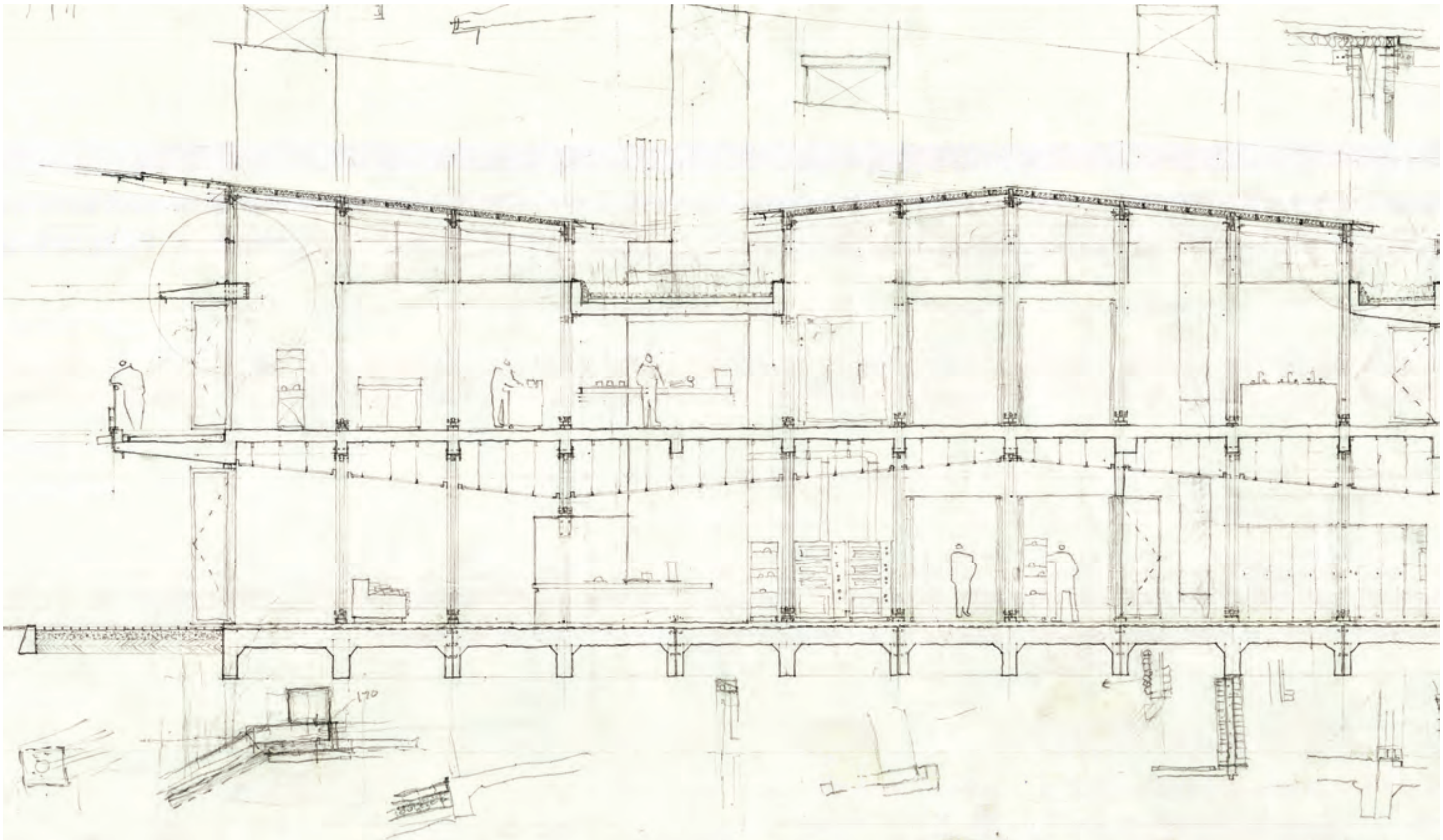
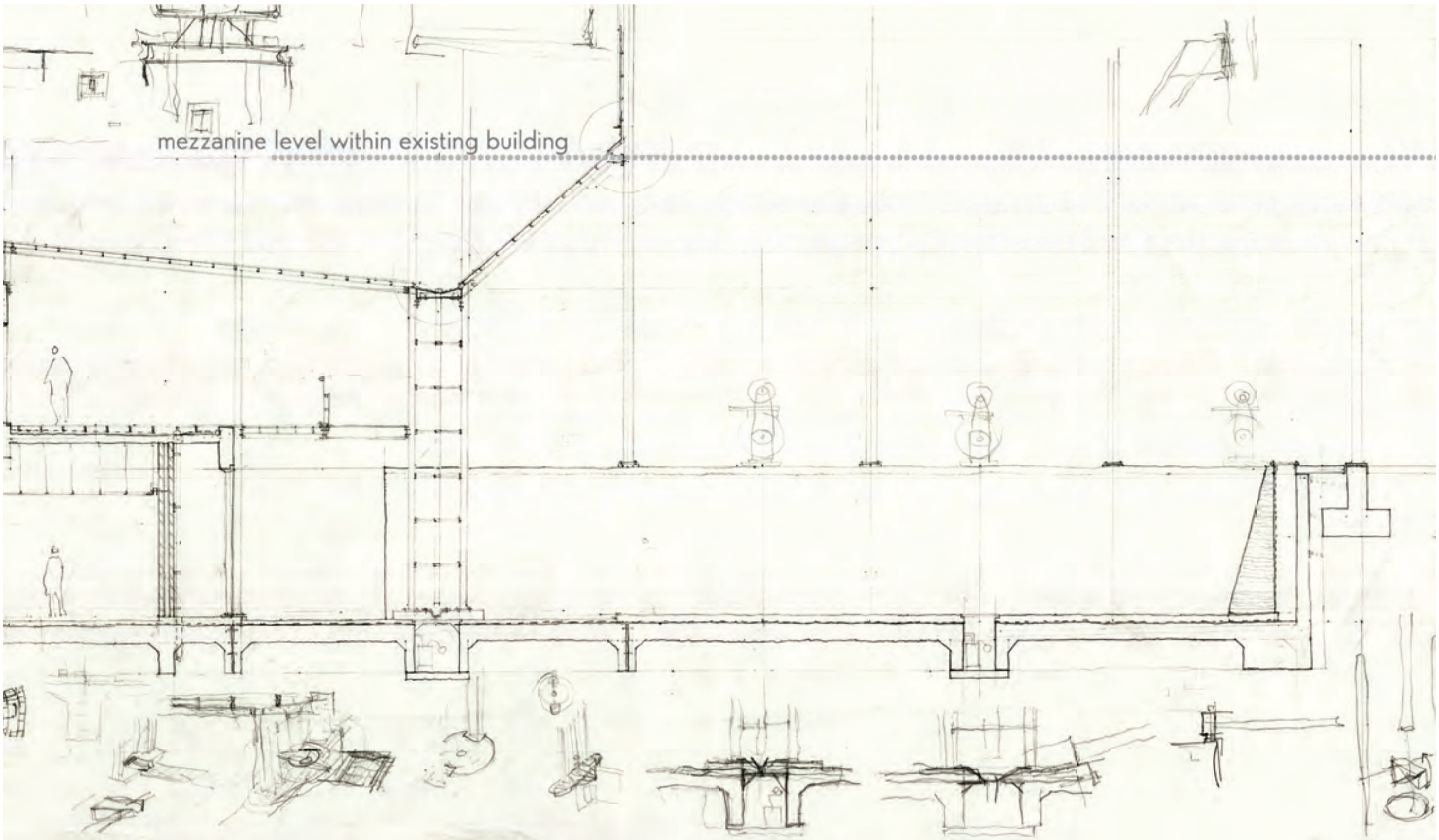


Figure 6.55. Section through machine viewing space, circulation hall and baking space facing West. Section was used as first exploration in technical development (Author 2014).


mezzanine level within existing building

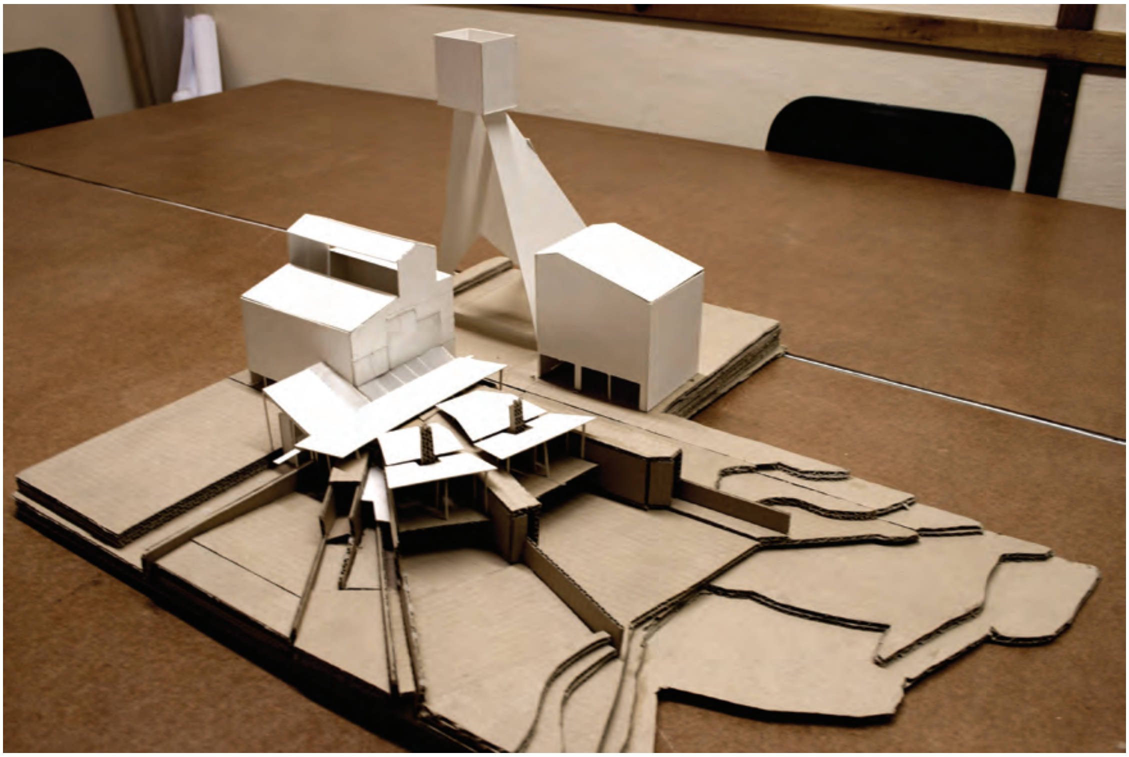
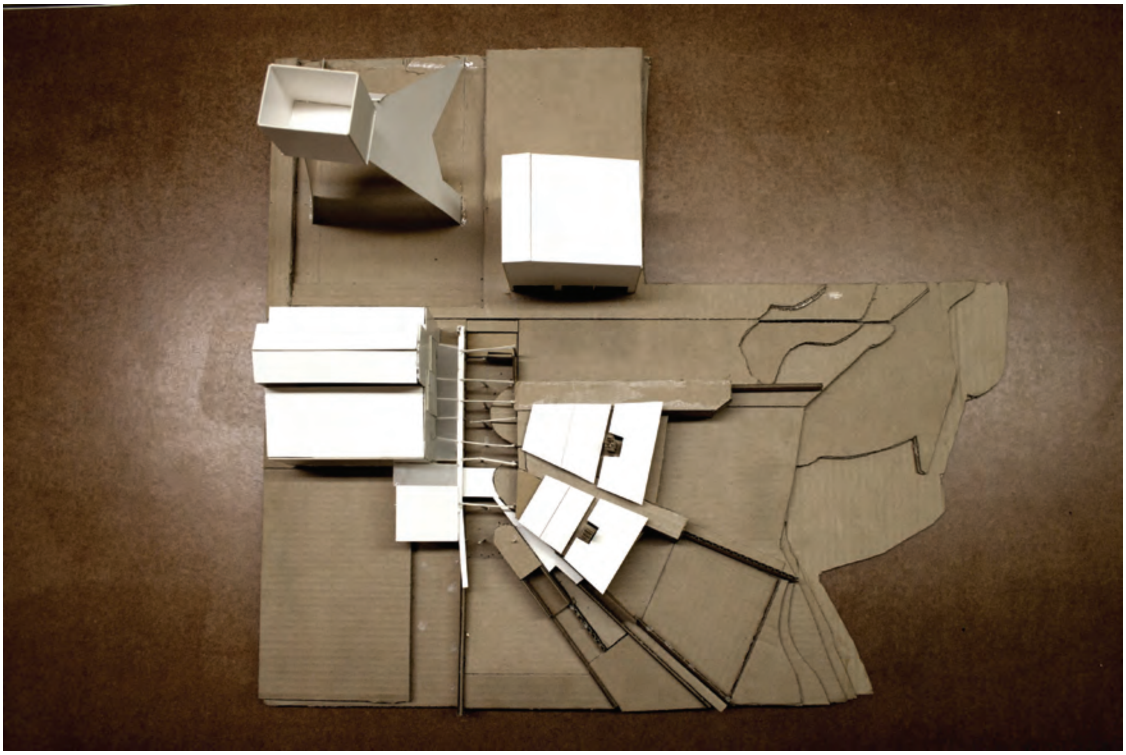


Figure 6.56. (top) Model at start of technical investigation, view from Southwest (Author 2014).

Figure 6.57. (bottom) The roof unfolding over the landscape 1 (Author 2014).



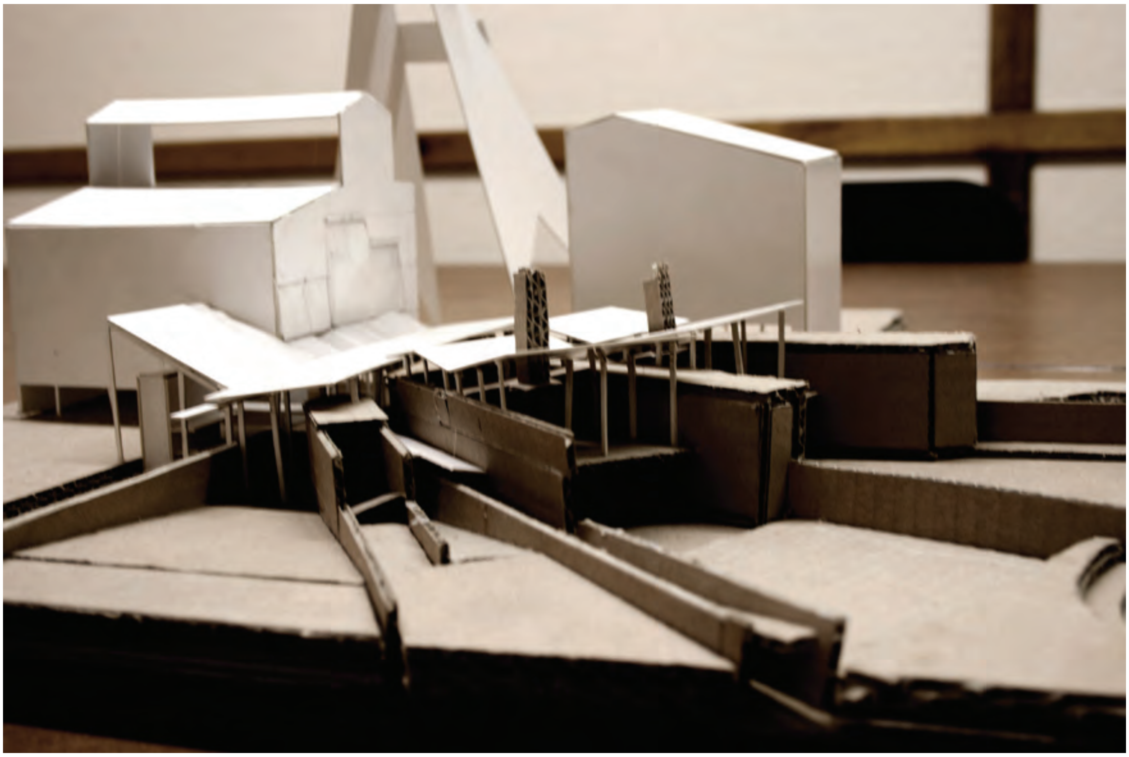


Figure 6.58. (top) Model at start of technical investigation, top view (Author 2014).

Figure 6.59. (bottom) The roof unfolding over the landscape 2 (Author 2014).

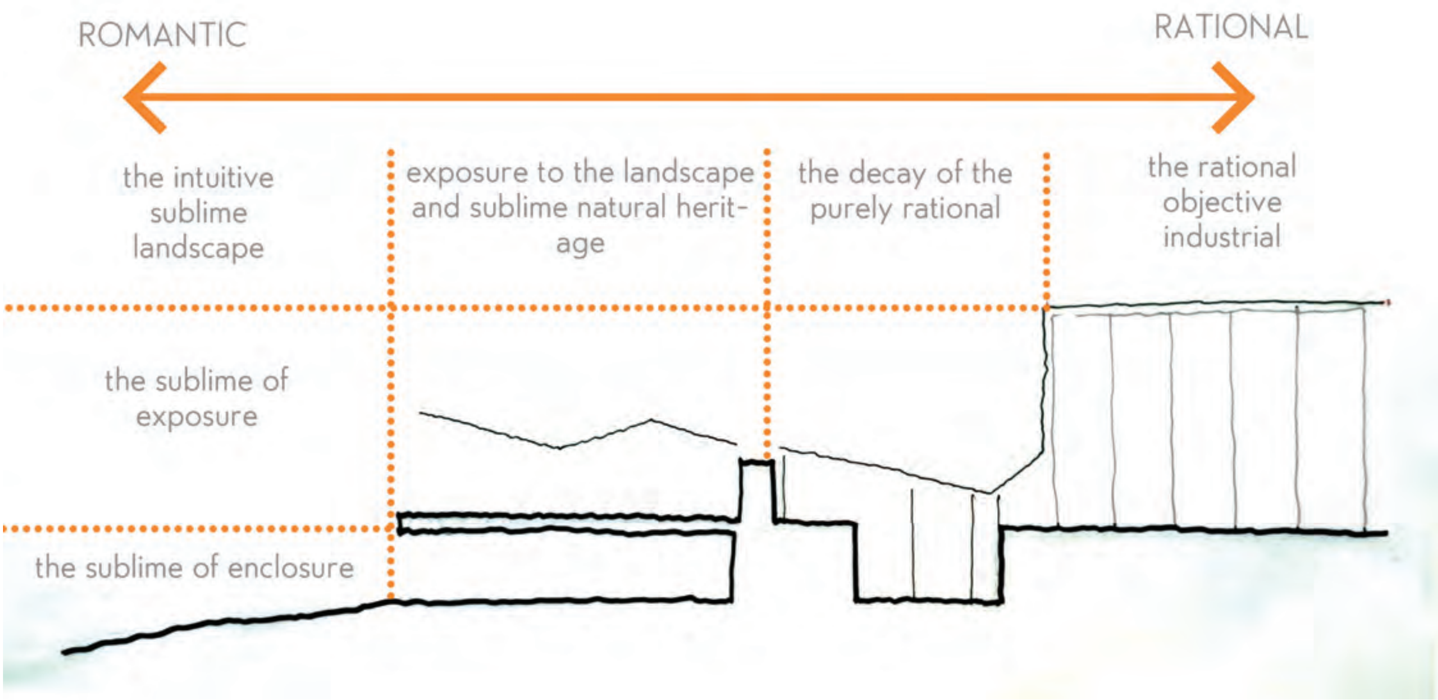


Figure 7.1. Tectonic concept: A form as threshold between rationality and the sublime (Author 2014).

Chapter 7
Technical development

*'The full
tectonic potential of any building stems from its
capacity to articulate both the
poetic and the cognitive aspects of its substance.'
(Frampton 1995: 26)*

7.1 The tectonic concept

Before the technical aspects of the design is discussed it is important to explain the concept which informed the decisions made during the technical development of the building. This concept expands of the concept developed in chapters 5 and 6. The aim here was to unpack the concept in such a way that it became the informant in the development of construction, detailing and systems within the design.

The tectonic concept is explained in the diagram in Figure 7.1. The concept takes into account two major conceptual ideas that have been present within the development of the design.

The first is the building as form which links the rational extant fabric and its sublime elements with the romantic landscape and its sublime elements. The building form which might achieve this was developed in chapter 6. Equally important is the way in which this form is realised, the way in which the building is constructed, the materials chosen and the detailing of the building.

The building is considered as a form between the rational man made and the natural romantic landscape. In Figure 7.1 the building starts as a purely rational form in the extant fabric (right hand side of the diagram). Here the user is exposed to a rational structural system in the existing washer plant and its steel frame construction.

As the user starts to move through the building towards the landscape he or she is submerged into a circulation hall where the forms used start to become less rational. The same should be done with the construction. Although the steel structure is still used (albeit a new steel portal grid) its form and grid on plan starts to show less Cartesian and rectilinear methods of construction. This is where the building form starts its decay from the purely rational towards the romantic landscape.

As the user moves yet further toward the landscape and the open pit, the construction of the building becomes even less rational to resonate with the intuitive forms of the building. Here the construction of the building, how the roof is held up, and how openings are spanned become less evident. Structural elements, like the columns holding up the folding roof over the production spaces are hidden. These columns for instance, sit within the massive elements of the building and are hidden from outside view by glazing.

The use of industrial rational steel elements and materials like polycarbonate and concrete is replaced with a more natural materiality. Timber and Kimberlite clay bricks are used, clay and wood being linked to the idea of mortality as discussed in chapter 6, a more romantic materiality. After this the user is exposed to the raw landscape and its vast scale. The construction and form of the building is considered as a threshold which decays from the rational industrial towards the romantic natural.

The next important design concept which influenced the technical resolution was the sublime elements found in the natural and man-made landscape of Cullinan. The two juxtaposed types of sublime spaces of exposure and enclosure which can evoke emotion through their sublime nature.

The sublime of enclosure is brought into the tectonic concept as cave like spaces, like the baking space and some pathways into the landscape, where heavyweight materials and construction is used (the lower part of the diagram). The sublime of exposure is realised within the building and the concept with spaces where lightweight construction is used, such as the main circulation hall with its steel columns or in the production spaces on upper ground level where timber columns are holding up a roof which seems to float over the landscape.
`

This concept was taken into account during the technical investigation of the design. It should also be mentioned that because of the approach to design within this dissertation (a more intuitive method), most of the drawings in this section was drawn by hand. In the following parts of the chapter the program and material choices will be discussed.

Figure 7.2. A small scale flour mill (United Milling Systems 2014).

After this the structure and construction of the building and all of its iterations and explorations (up to the date of hand in) will be presented, followed by the systems which were proposed. After this some of the details of the building will be presented and discussed.

7.2 Program

The program and the theoretical position influencing it has already been mentioned in chapter 5 and chapter 6. As part of the technical development, the functional requirements of the program and how it actually works in the spaces of the building was investigated.

7.2.1 The milling process

As part of the program a small scale mill is proposed. This mill will process grain which was grown within the proposed agricultural belt, as well as grain supplied from farms within the region. The flour produced could be sold to the public as well as being used for baking bread within the bakery itself.

The type of milling machines that would be appropriate for this scale of plant would be a roller mill or a horizontal stone mill (Posner 1997: 126). A roller mill is generally used for a higher output of flour in a larger scale mill, while a stone mill requires more maintenance, but produces better quality flour due to lower running temperatures. A stone milling plant is seen as more appropriate within the urban vision, as the higher maintenance and labour skills required to dress the stones would create more opportunity for trade skill development in addition to producing better quality flour

Flour mill type 5

For production of conventional white flour and whole meal flour.
Cap. Up to 1200 kg/hour
Minimum space required 8 x 20 m.
Height 6 m. at the highest point.

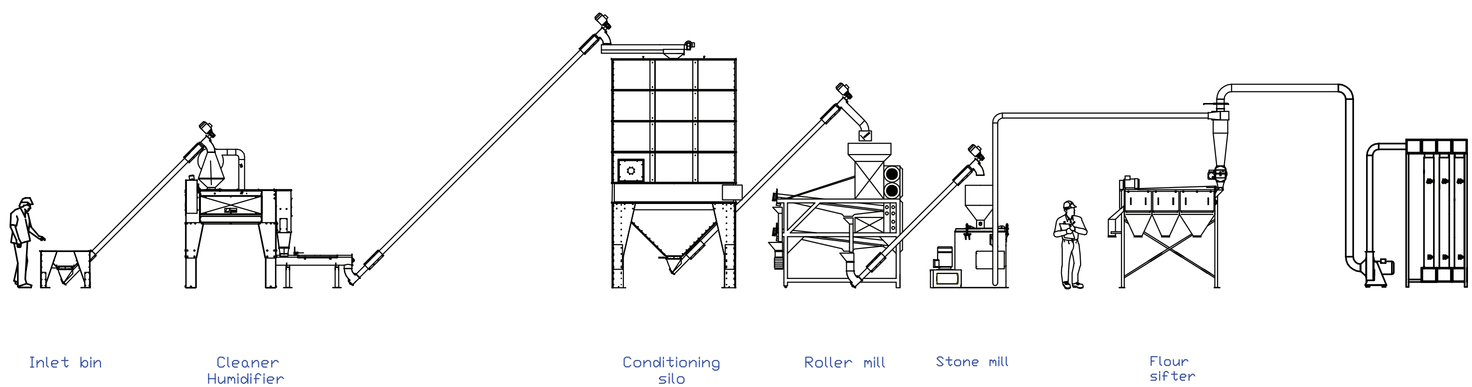


Figure 7.2 shows a diagram of the machinery required a typical small scale flour mill process (United Milling Systems 2014). Note that for this project the roller mill would be replaced by another stone mill. After the flour has been sifted it would be packaged and stored on site for use within the bakery or for sale to the public. Due to the volume of space required to house the machinery (Figure 7.2), it is proposed that the mill be housed within the existing washer building as shown in Figure 7.5. Raw grain is delivered on site at in the service yard located to the Northwest of the site (1). From here it would be stored in a grain silo (2). Next it would be processed in the mill (3) and stored (4) in the existing washer plant ready to be sold or used in the bakery.

7.2.2 The baking process

The typical baking process is described by DiMuzio (2010) as And Scribd.com (2014) as follows (Figure 7.3). Figure 7.3 shows the appliances required in each step and their sizes (Alpaco catering equipment 2009 and Premium kitchens 2009).

Step 1 (Mixing): The flour to be used in the dough is selected and mixed. The wet and dry ingredients are mixed together in a bowl and kneaded either by machine or by hand. In this project it is proposed that both mixing and kneading machines as well as hand methods are used, depending on the desired product. The dough is also undergoes its first fermentation in the mixing bowl, after which it is knocked back and kneaded again. `

Figure 7.3. The baking process and required equipment (Author 2014).

Step 2 (Proofing and fermentation): In this step the dough is moulded and shaped either by hand or with a bread moulder. After this the shaped dough is proofed in a prover or in a warm dry place to allow for fermentation of yeast before baking.

Step 3 (Baking): Here the dough is baked in either a wood fire oven, gas oven or electrical oven to produce the bread. The oven used depends on the desired final product, but in general a gas oven is comparable to an electric oven.

Step 4 (Packaging): The final baked product is packaged, mostly by hand. A clean work surface is required as well as storage space for the packaging and packaged product.

step 1

Stainless steel tables with splash back. Dimensions: 1700x900x610mm
Underbar fridges. Dimensions: 2400x915x650mm
30 litre dough mixers. Dimensions: 480x730x770mm
5 litre food mixers. Dimensions: 430x525x280mm
20 tray stainless steel trolleys. Dimensions: 470x1730x630mm

step 2

Stainless steel tables with splash back. Dimensions: 1700x900x610mm
Underbar fridges. Dimensions: 2400x915x650mm
Double door electric provers. Dimensions: 985x1870x710mm
Dough sheeters. Dimensions: 2430x1230x870mm
Dough roller/moulders. Dimensions: 640x2100x540mm
20 tray stainless steel trolleys. Dimensions: 470x1730x630mm

step 3

Stainless steel tables with splash back. Dimensions: 1700x900x610mm
Underbar fridges. Dimensions: 2400x915x650mm
Triple deck LPG baking ovens. Dimensions: 1310x1840x970mm
20 tray stainless steel trolleys. Dimensions: 470x1730x630mm

step 4

Stainless steel tables with splash back. Dimensions: 1700x900x610mm
Underbar fridges. Dimensions: 2400x915x650mm
20 tray stainless steel trolleys. Dimensions: 470x1730x630mm
Stainless steel shelving. Dimensions: 910x1800x455mm

equipment

7.2.3 The programmatic process in the design

The typical baking process as discussed above usually takes place within a single space. In chapter 5 it has been explained that the separating of the program into different spaces, along with a lower reliance on machinery might also serve in linking the user with the landscape. Keeping this in mind the programmatic functions were placed in the building as follows.

Deliveries and mill (Figure 7.5): Raw grain is delivered on site at in the service yard located to the Northwest of the site (1). From here it would be stored in a grain silo (2). Next it would be processed in the mill (3) and stored (4) in the existing washer plant ready to be sold or used in the bakery.

Mixing (Figure 7.6): Flour is moved from storage with the use of stainless steel trolleys into the mixing space. At the main entrance to the north of this space there are lockers and basins for staff to clean before they work (1). Here the flour is selected and mixed mainly by hand and also with mixers as described in step 1 of 7.2.2. The mixed dough is then again placed on a stainless steel trolley which is lowered down using a pulley operated goods lift to the proofing space (2).

Fermentation (Figure 7.7): Just as with all of the production spaces, the fermentation space (1) has space for lockers and basins for staff to clean before work begins. In this space the dough would be moulded and proofed as described in step 2 of 7.2.2. It is proposed that along with proofing machines a wood fire would be used to create a suitable warm climate for proofing on shelves as well as heating water with the use of a heat exchanger. After the dough has been proofed, it is again placed on trolleys and moved across to the baking space.

Figure 7.4. Vegetation on the Kimberlite reservoir (Author 2014).

Baking (Figure 7.7): Here the dough is baked with the use of gas ovens (with gas storage outside the space [2]) and with a wood fired oven (3). The fire also heats water with a heat exchange system and fuels a ventilation stack. After the bread is baked it is placed on a trolley as before and hoisted up with a hand operated goods lift (4) to the packaging space above.

Packaging and sales (Figure 7.8): In the packaging space above the baking space the bread is packaged by hand (1). After this the product is moved as indicated in the figure to the sales counter where it is sold to the public (2).

These spaces were designed to accommodate for the equipment shown in Figure 7.3.

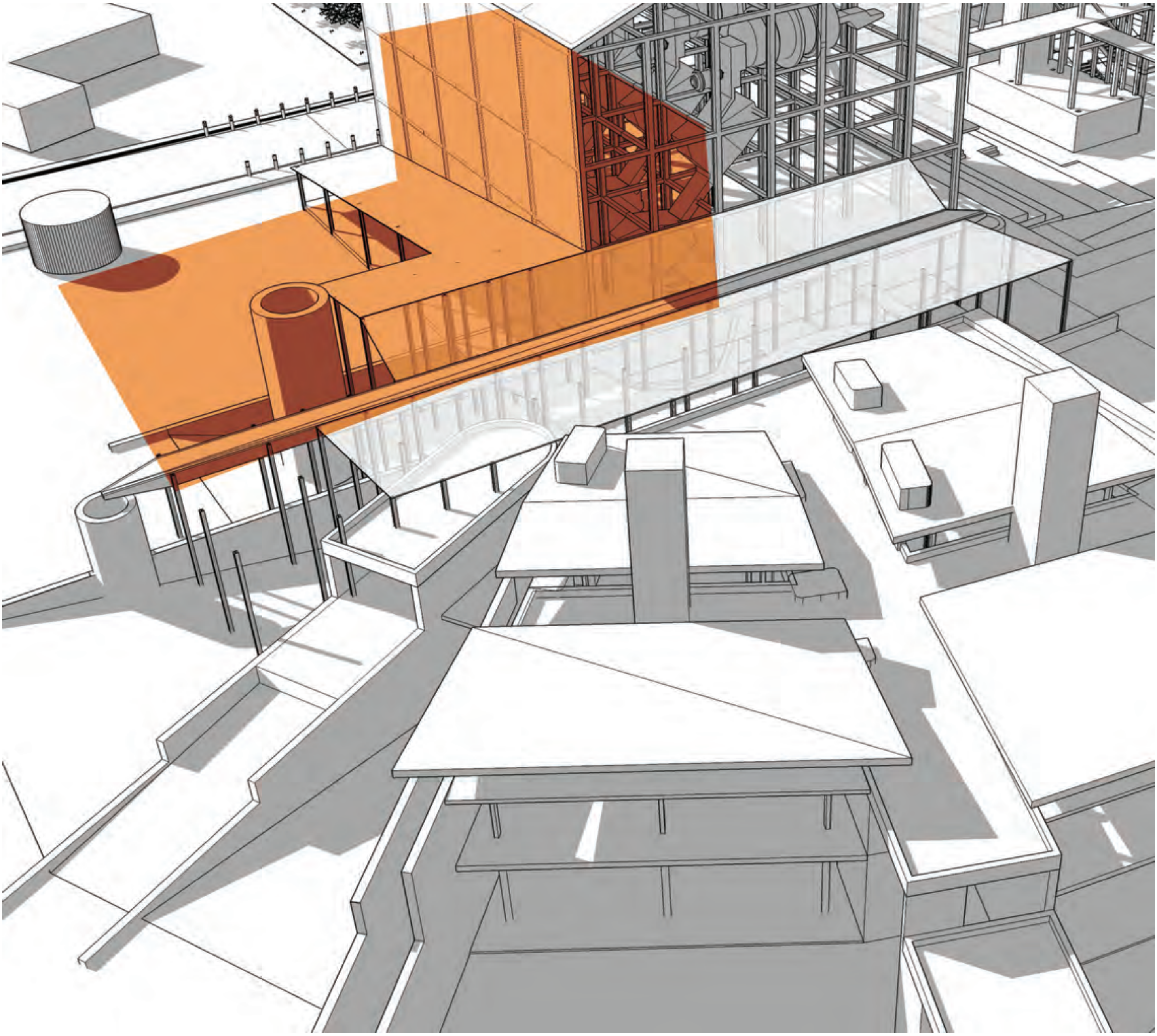
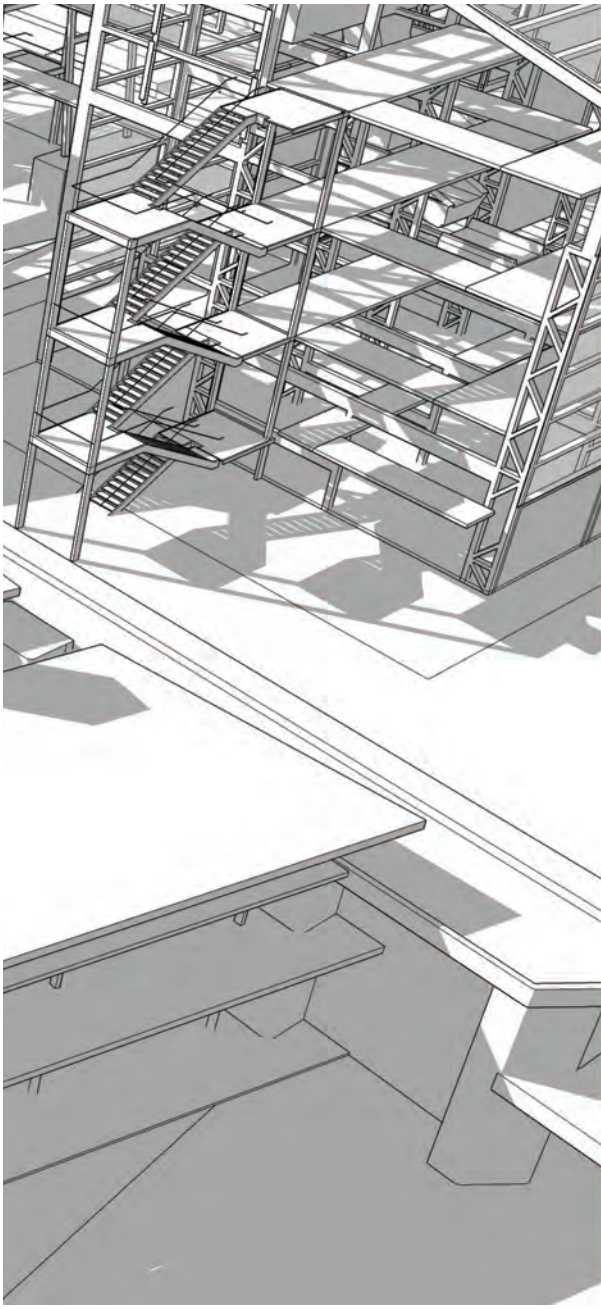
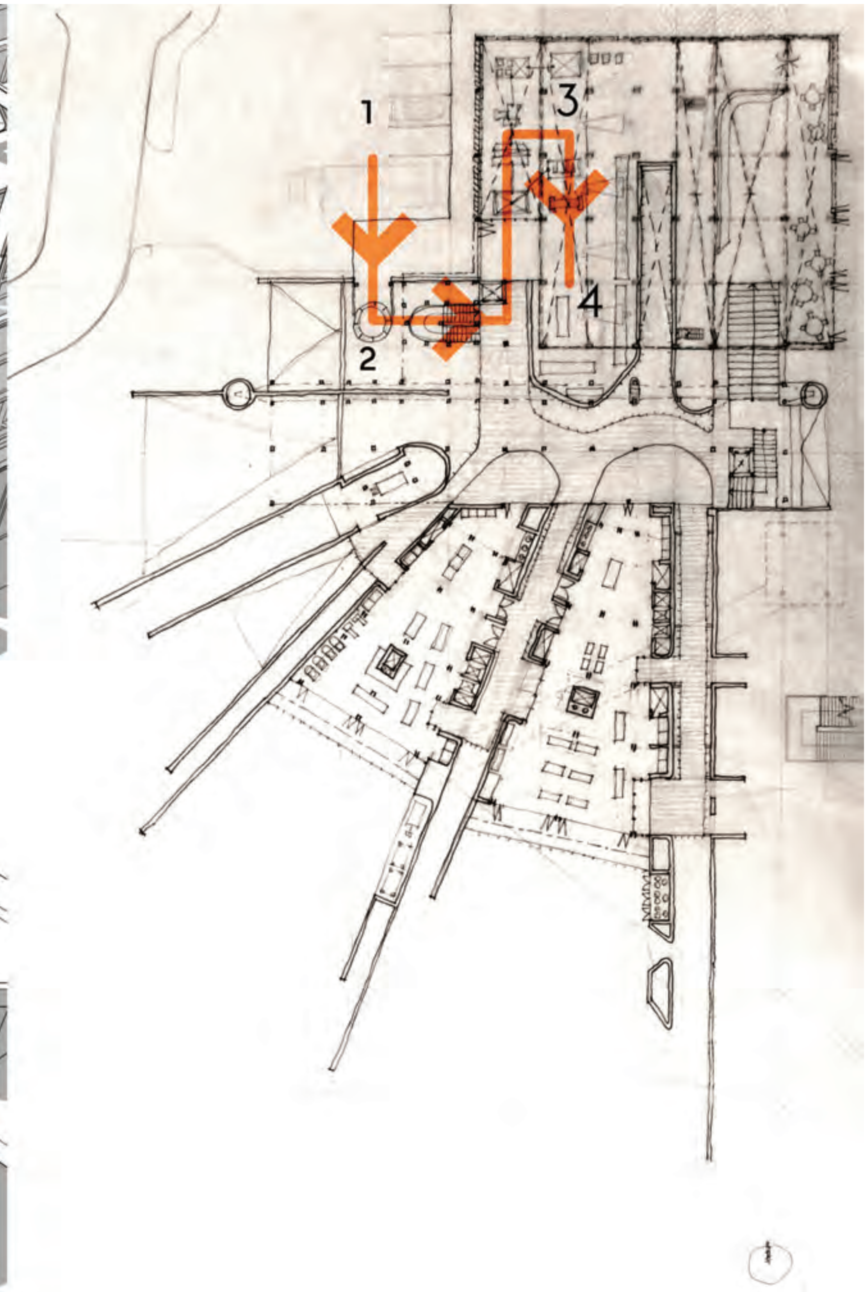


Figure 7.5. Deliveries and mill on upper ground level (Author 2014).

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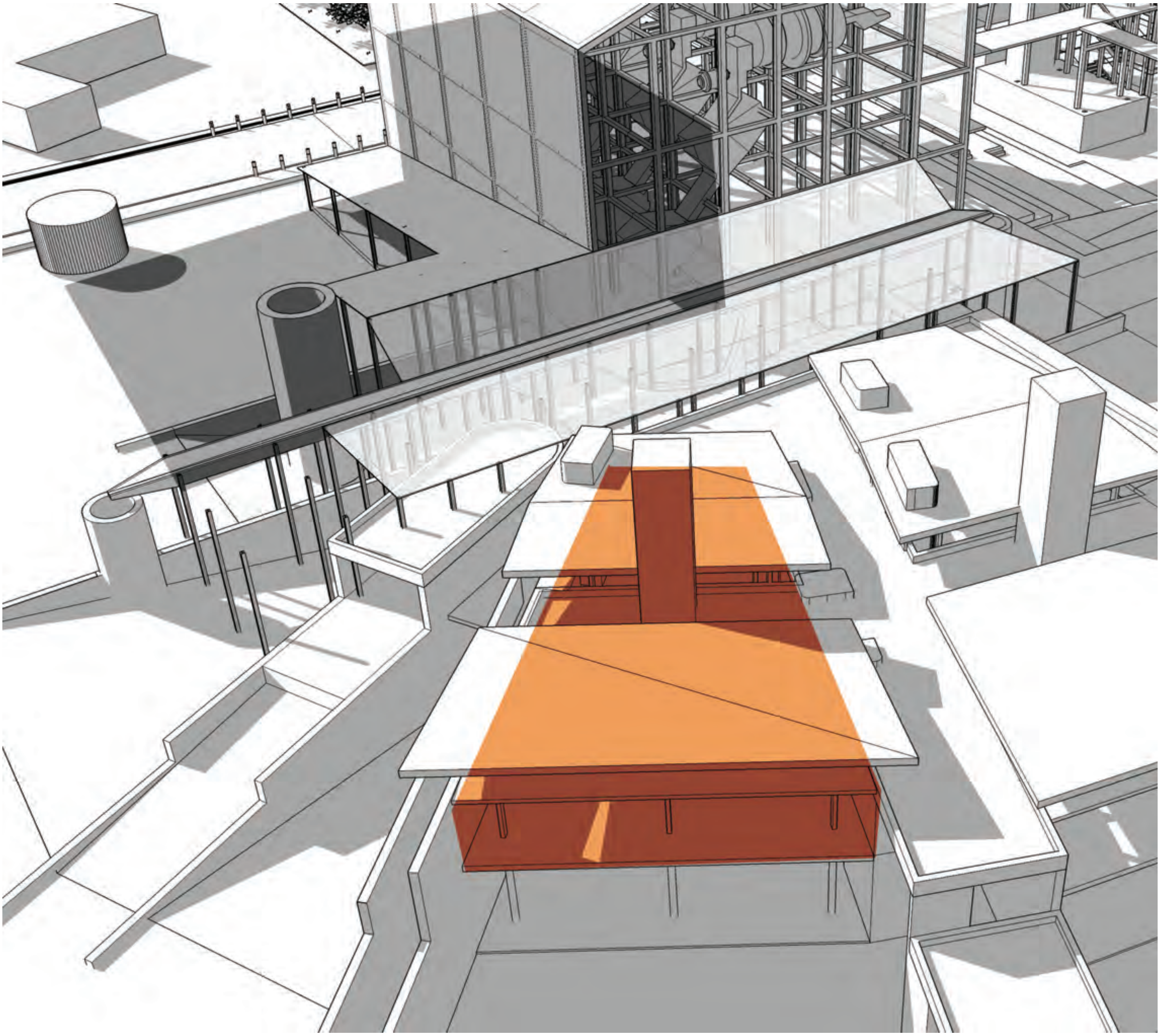
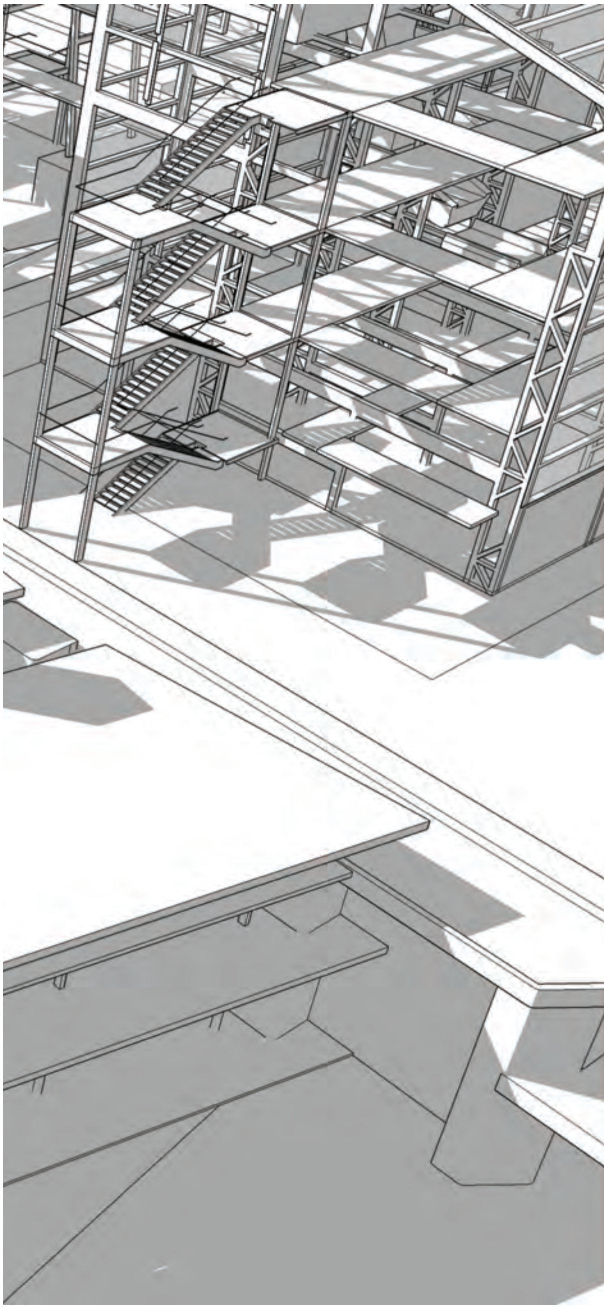
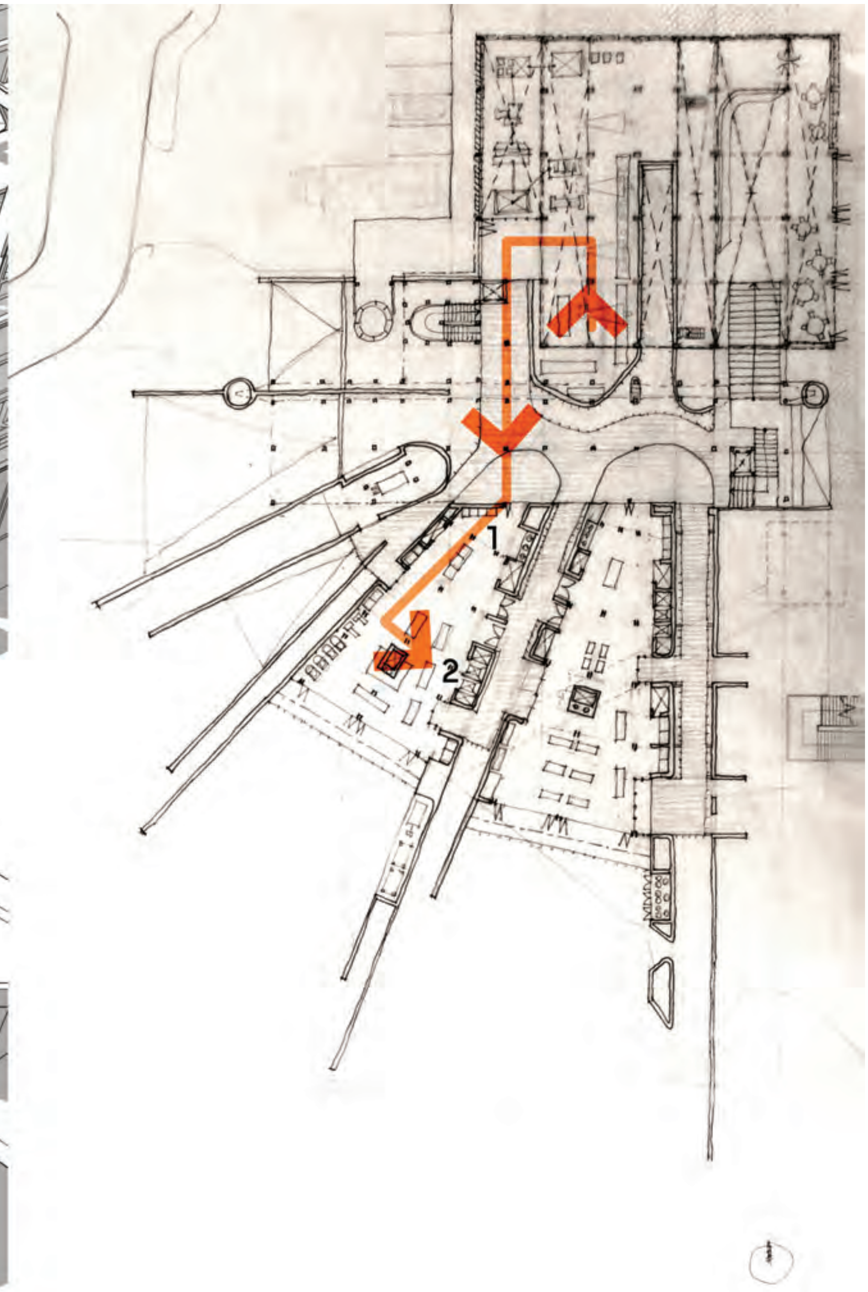


Figure 7.6. Mixing on upper ground level (Author 2014).

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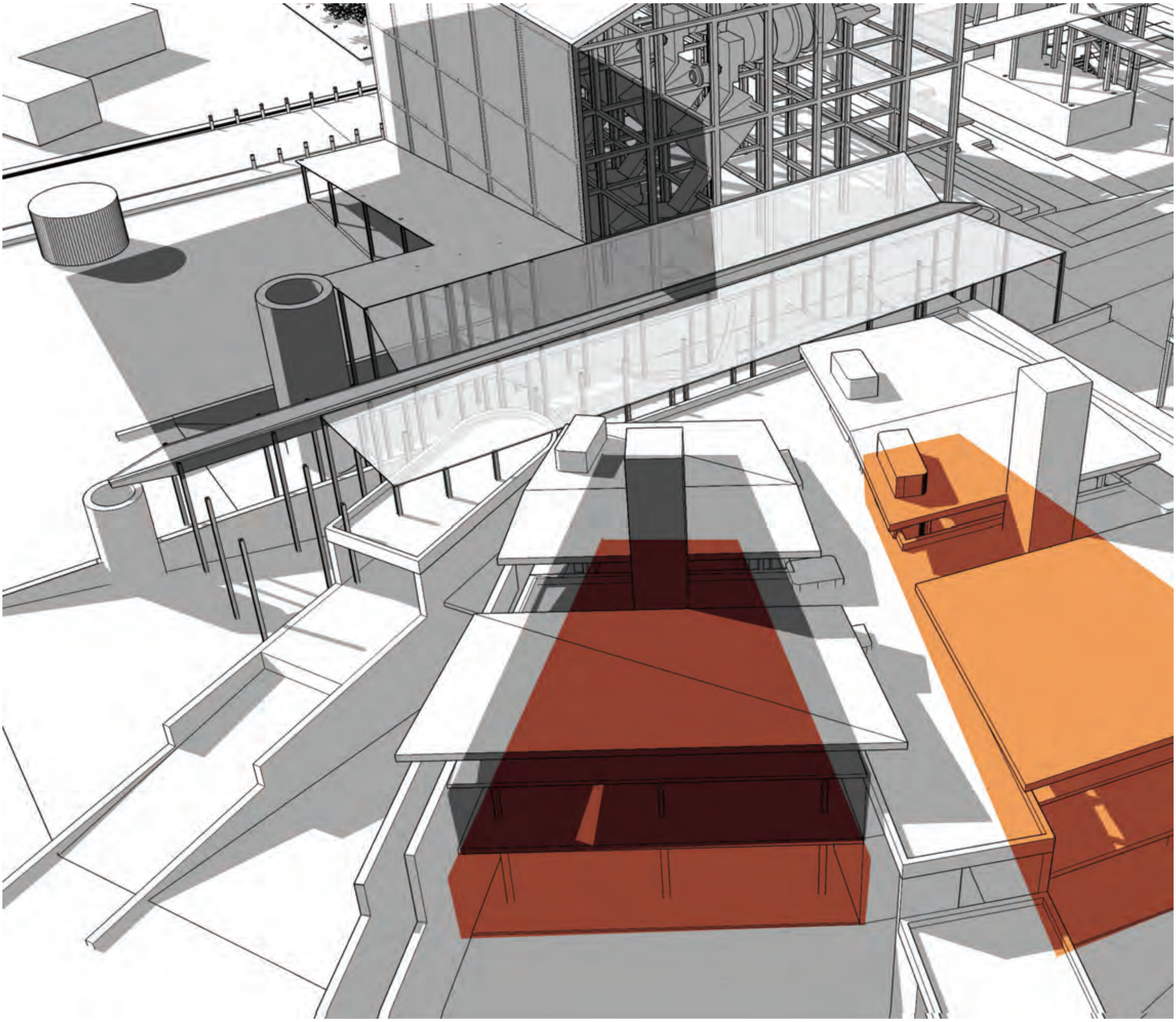
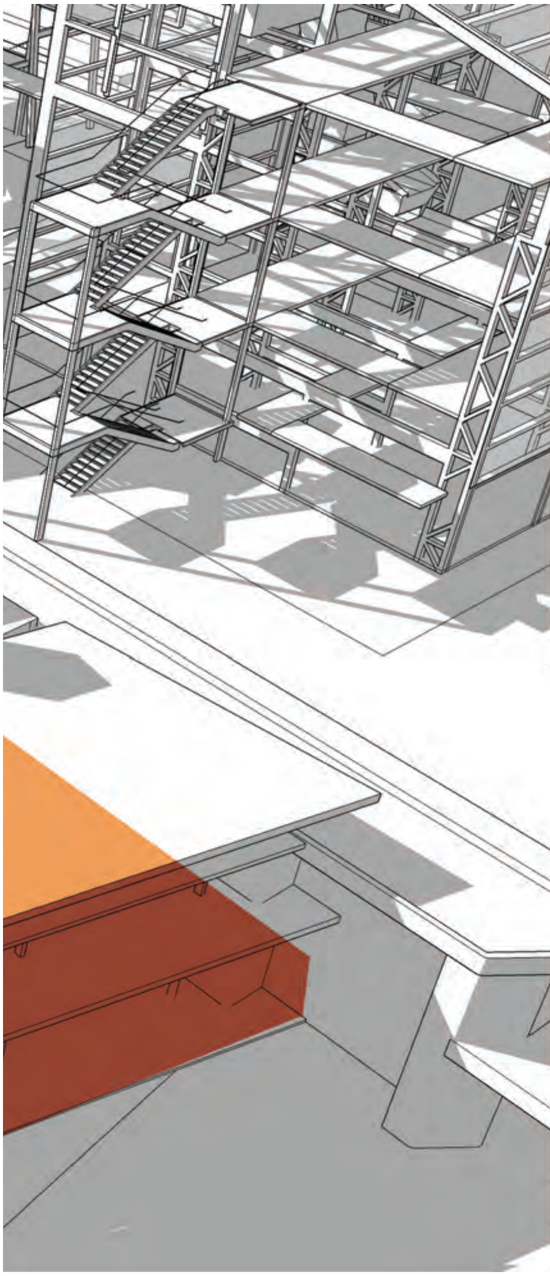
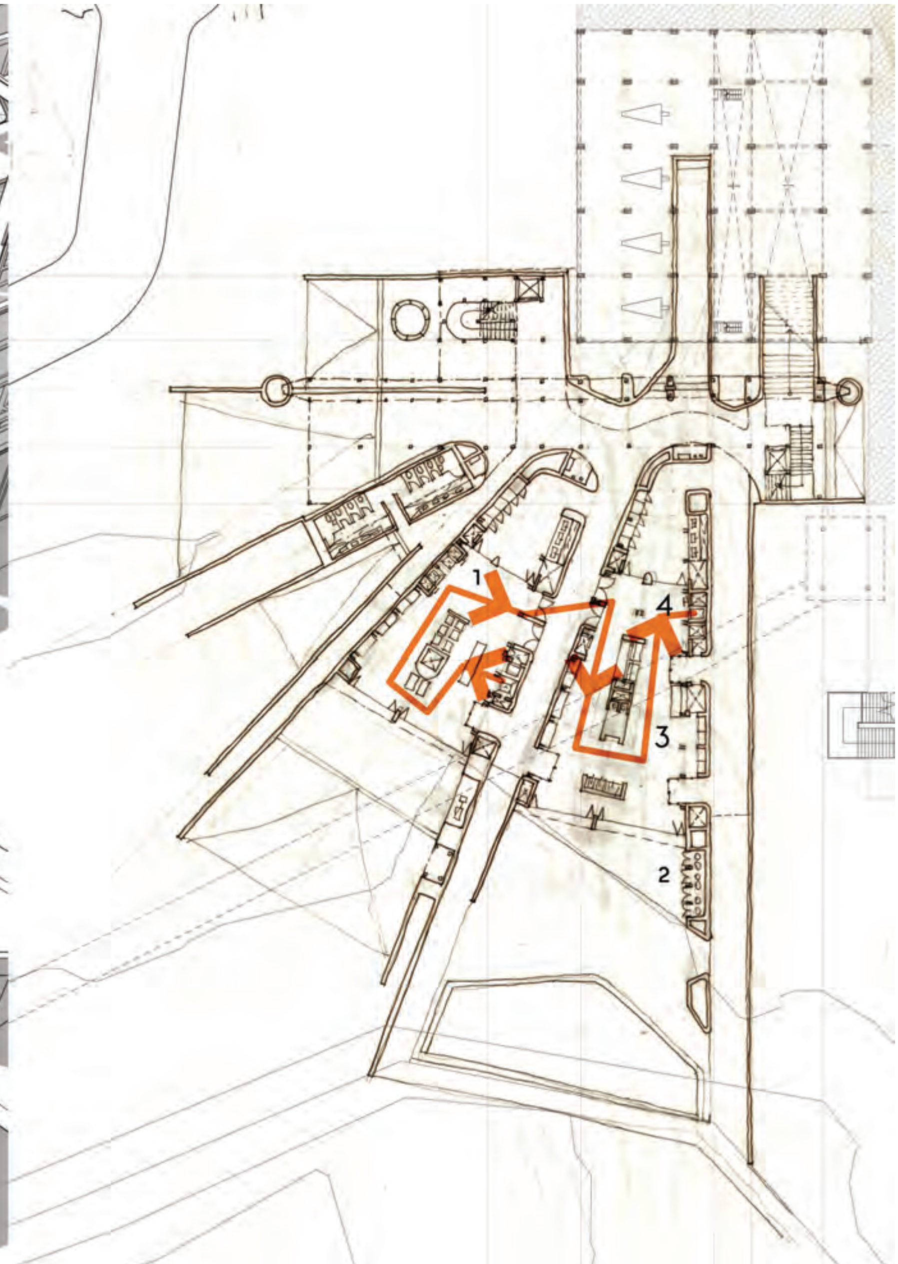


Figure 7.7. Proving and baking on lower ground (Author 2014).

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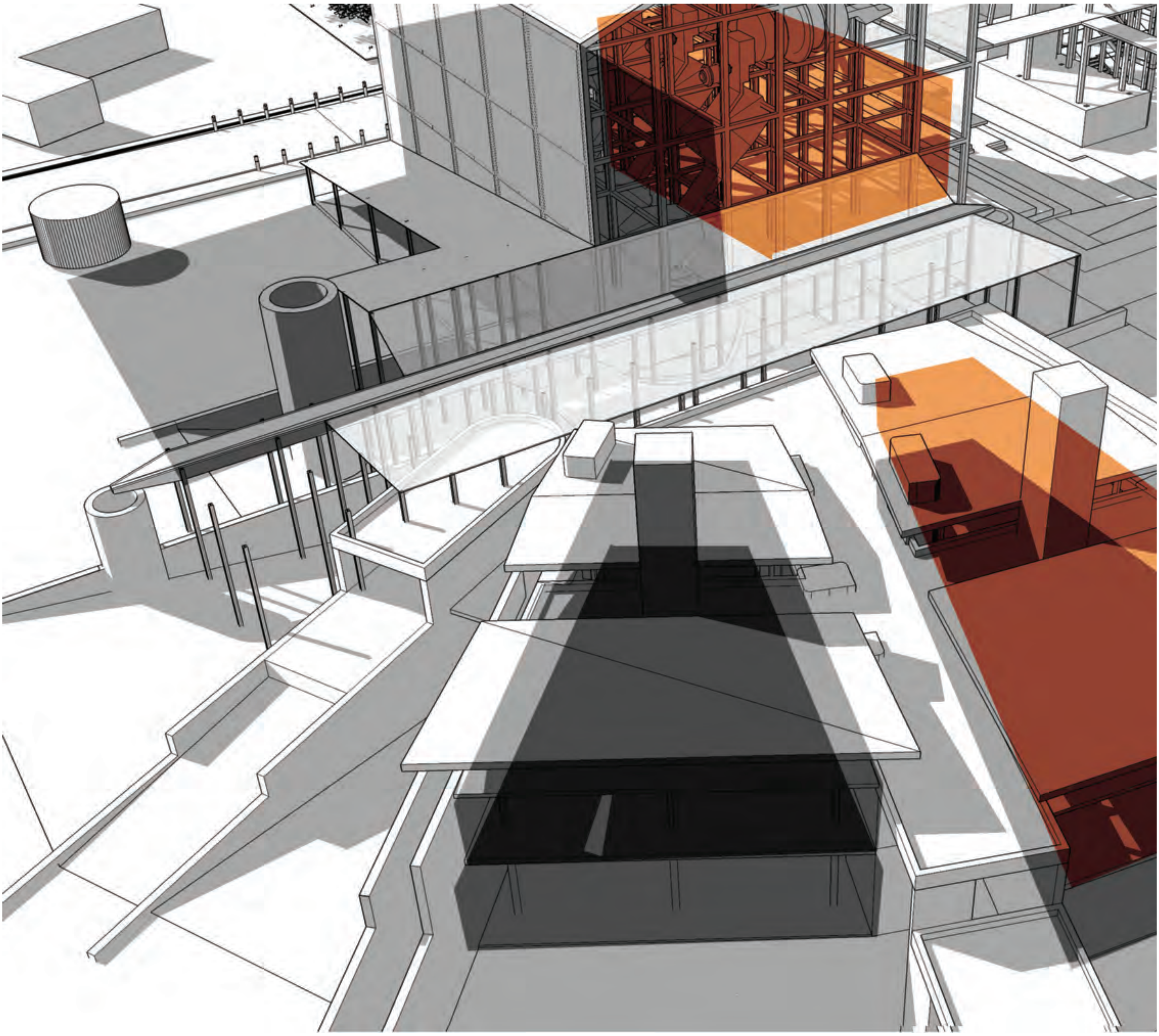
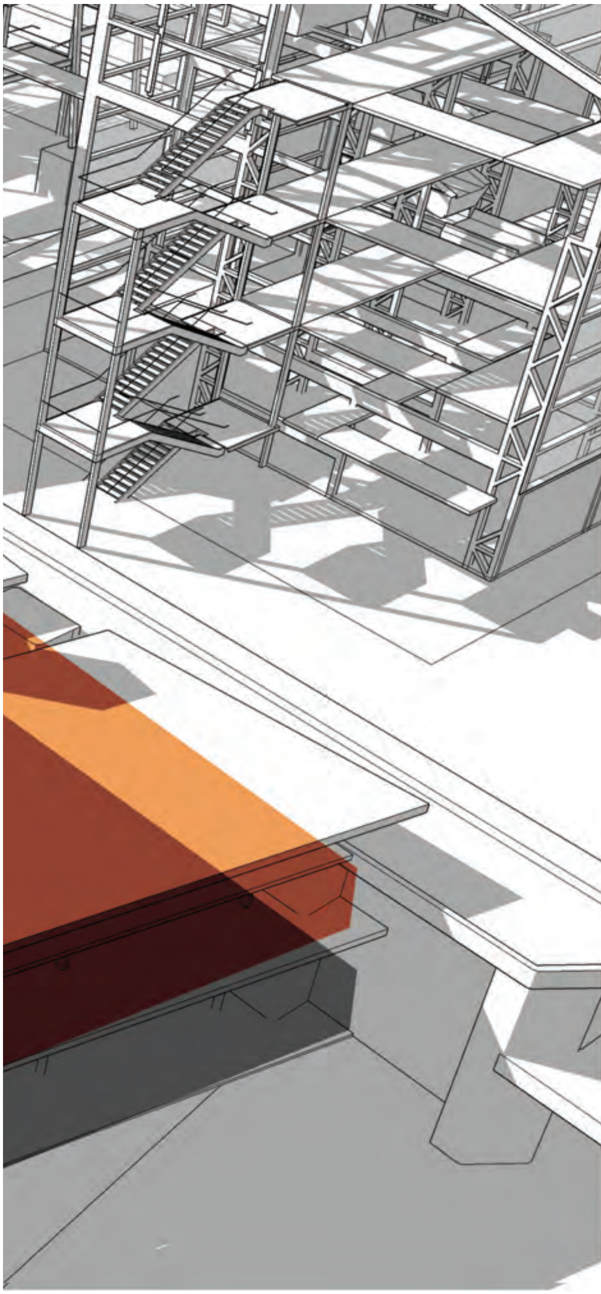
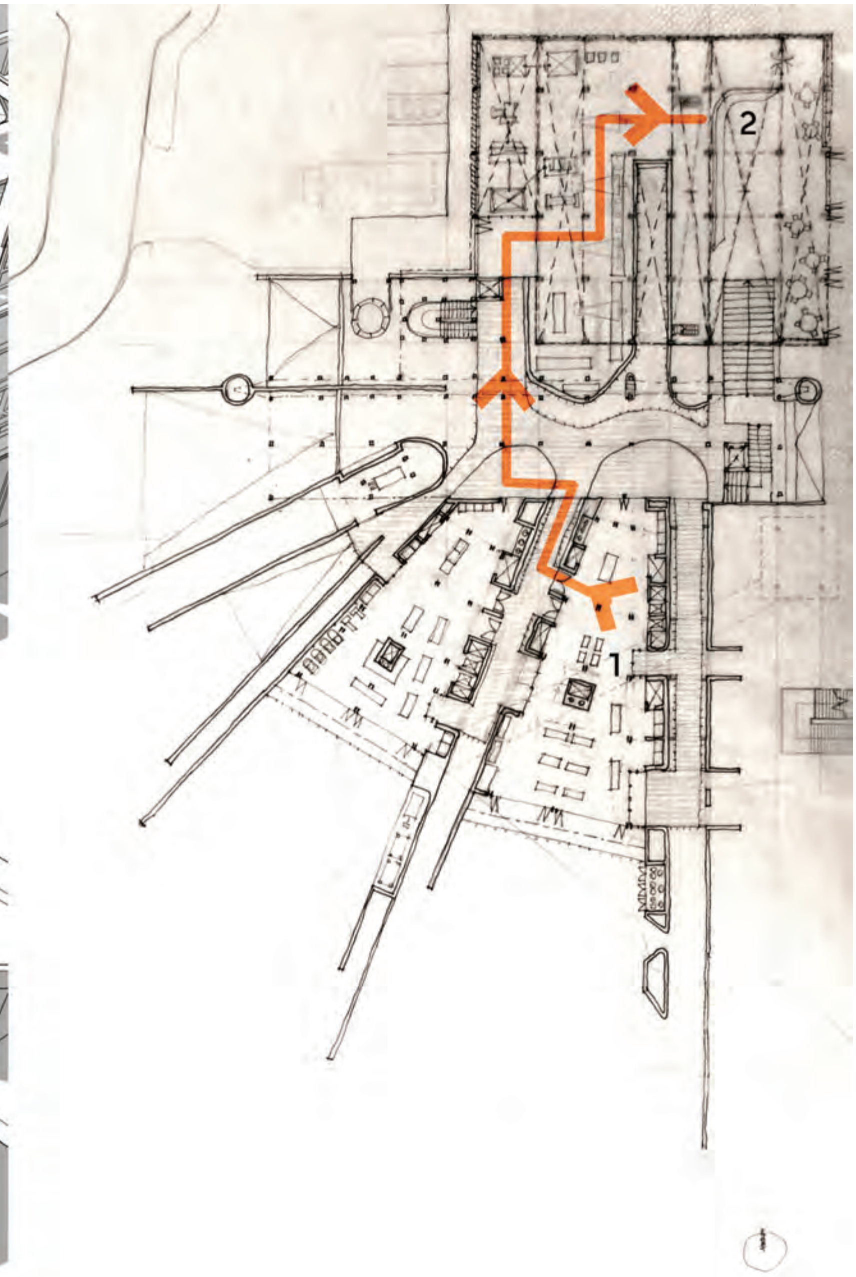


Figure 7.8. Packaging and sales on upper ground level (Author 2014).

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7.3 Materiality

The main materials used in the construction and design of the building are shown in Figure 7.9 and 7.10. The reasons for their choice, where they are used and how they link to the tectonic concept follows.

7.3.1 Kimberlite clay bricks (1, 2, and 3)

The soil on site and in the area contains a large percentage of Kimberlite, which has been extracted in the diamond mining process. The site itself is located on the Kimberlite tailings reservoir, a transient mound of earth. In 2009 Callie Botha and the South African for Geoscience developed a method for the manufacture of clay bricks using Kimberlite found in Cullinan. The Mine itself has already invested R6.1million towards this project (Angel Investment Network 2014). The plant is to be commissioned just before the closure of the mine as part of the rehabilitation program.

It is therefore safe to assume that kiln fired Kimberlite clay bricks would be an abundant local material. As suggested before, it is proposed that the heavy structural walls in the building is to be constructed using this material. The use of clay bricks also presents us with the opportunity to use the brick coursing to emphasise the concept of a threshold where the rational decays into the landscape. Brickwork on the rational side of the building can be built using a rational stretcher bond (1) as one moves into the landscape through the building the coursing can become more rustic and different patterns can be used (2 and 3).

Figure 7.9. Materiality part 1 (Author 2014).

7.3.2 Reinforced concrete and cement screed (4)

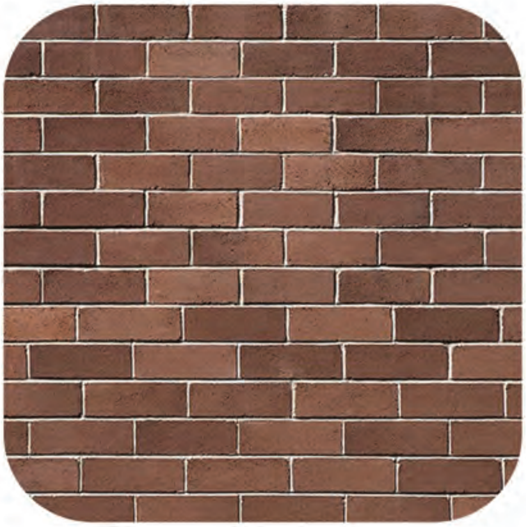
Because of the clay content of the soil and the fact that there may be mining tunnels underneath the building a raft foundation system is proposed. Where needed 330mm brick bearing walls may also be reinforced using concrete. A cavity basement and retaining wall system is proposed, as most of the lower ground level is beneath the natural ground level (Figure x). This means that no-fines concrete will also be used in construction.

In most of the building however, facing walls are either bearing brick walls, have a brick facing leaf to create a cavity (retaining walls) or are cladded with bricks. Where concrete will be visible though is where a concrete coping is used to cap exposed brick parapets (Figure x). Most of the floors will also be finished in with a power floated cement screed.

7.3.3 Standing seam zinc roof sheeting (5)

This type of roof construction (Figure x) was chosen because of the tapering forms the lightweight roofs that fold over the landscape have. If normal corrugated roof sheeting had been used, the tapering edge details would have had more awkward due to the corrugation ribs being parallel. One can however taper the seams with a standing seam roof cladding system, allowing the edge seams to be parallel to the tapering edge.

Another consideration in the choice of roof material was the finish. The lightweight roof structure sits in the part of the building where the rational has decayed into the landscape (Figure 7.1). A material that shows aging was therefore considered. Standing seam zinc sheets can be supplied with a finish that already has a weathered patina (Rheinzink 2013: 11) and would thus be appropriate conceptually.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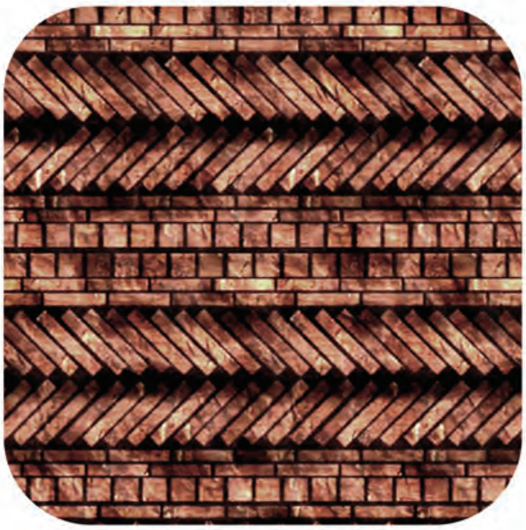
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7.3.4 Steel structural members (6)

It is proposed that the roof over the main circulation space next to the existing washing plant be constructed using steel portal frames, built from 152mm H-profile members (Figure x). This is the first space where the rational decay starts to appear according to the concept. The steel members used in the construction in the washing plant has been galvanised to protect them from oxidisation. The new structure's steel members should also be protected against oxidisation (Ching 2008: 12.08). It is proposed that these steel members be painted using a dark grey paint. This will set them apart from the raw galvanised members of the extant fabric.

7.3.4 Treated pine (7)

The lightweight roof structure over the production spaces is proposed to be constructed from SA pine timer members. These members need to be treated, but are not exposed to harsh conditions and are detailed to not be overly exposed on the eaves of the roof (Figure x). The hazard class of the timber therefore falls in either H1 or H2, depending on the insects present (Wegelin 2009: 34). A non-staining varnish treatment is proposed where the timber members are exposed. This will retain much of the natural colouring of the wood. The timber here needs to reflect less processed material as stated in the tectonic concept.

Tongue and groove ceiling boards are proposed within these spaces (Figure x). These boards cover up the majority of the structure lending the effect of a roof, not rationally supported, and floating over the landscape.

7.3.5 Multiwall Polycarbonate sheeting (8)

The roof covering over the main circulation space needs to have some degree of transparency in order to expose the rational form of the building starting to decay. Multiwall polycarbonate sheeting is proposed, as it is durable enough to be used as a roofing material (Duroplastic 2014). It is resistant to UV weathering and allows for some degree of transparency.

It should be noted that this space is covered but not enclosed to the outside. This, along with height of the space would minimise heat gain through these sheets, because this is an open covered space. Nevertheless it is proposed that 30mm five wall sheeting be used with a white opal UV Guard. This lowers the U-value of the sheet to 1.6 W/m2K, which is considerably lower than that of a single sheet of 6mm glass at 5.7W/m2K (Duroplastic 2014). The opal UV guard also decreases the transparency of the sheet to give it a small shading factor. This, along with the fact that this space is almost completely open on elevation will ensure a comfortable temperature.

7.3.6 Natural vegetation and gravel (9 and 10)

The building form where it meets the natural landscape is composed in such a way as to expose the user to the natural landscape by drawing the vegetation into the spaces between the pathways. For this reason the natural vegetation on site is considered as part of the material palette.

The building would also be seen from above by users in the adjacent structures. These people must not be exposed to the waterproofing on the flat parts of the roof (Figure x). It is proposed that these roofs be covered in gravel, which also mimics the colour of the Kimberlite clay in the soil.

Figure 7.10. Materiality part 2 (Author 2014).

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7.4 Structure and construction

A series of hand drawn sections (that were drawn on a scale of 1:50) were used to investigate the construction of the design. Drawing by hand served two purposes. The first, which has already been discussed, is that it is conceptually relevant as a more intuitive design method than digital drawing. I could also focus on the section as a whole whilst considering the details more carefully through a hand drawing, where as much detail as possible (on the chosen scale) was the goal. It was easier for me to do this with a hand drawing.

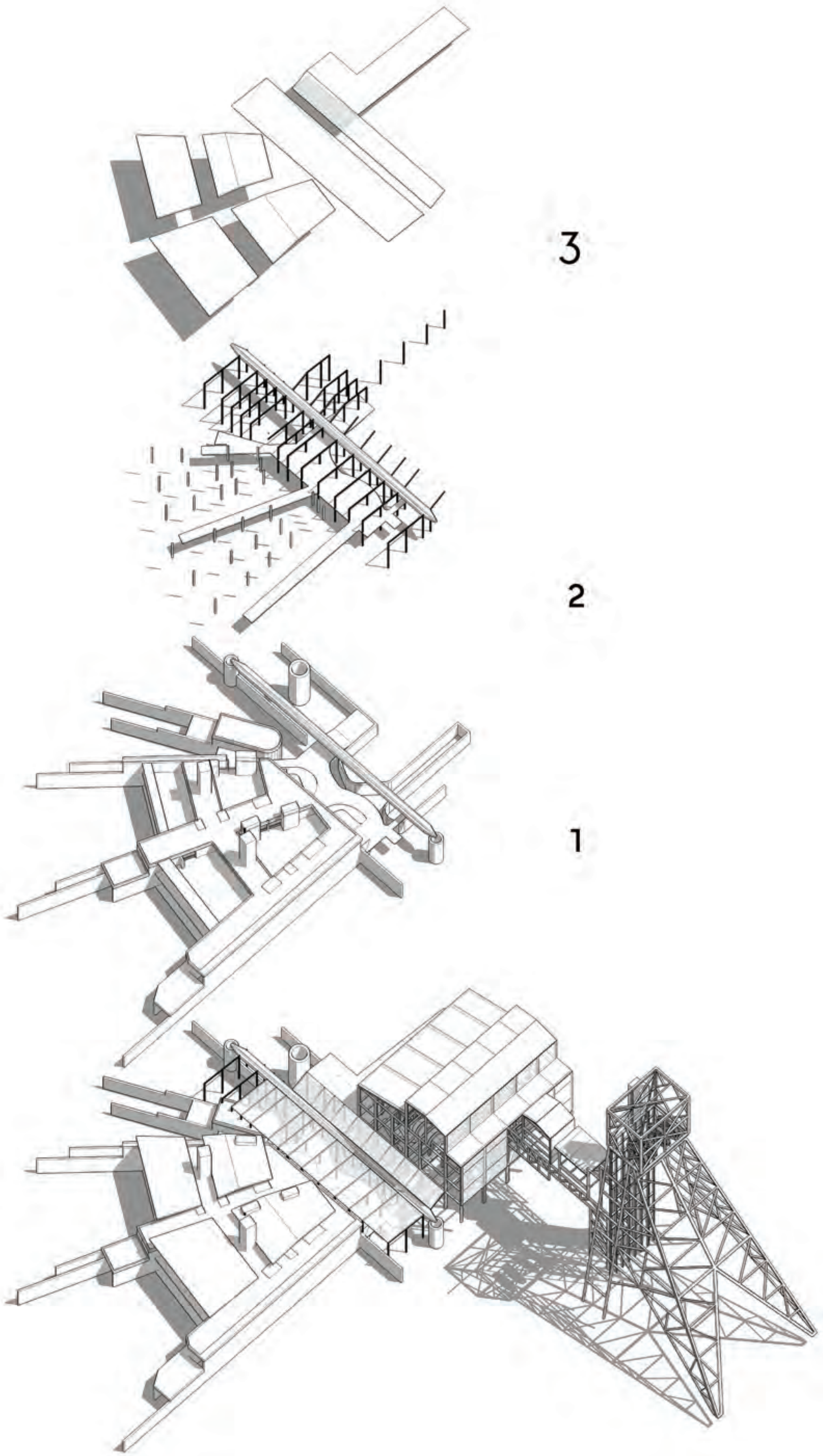
7.4.1 Structural logic

Figure 7.11 shows the main structural elements in the design. The first is the heavyweight structure which is partially submerged under the natural ground level (1). This structure, which aims to resonate with the sublime of enclosure, consists of reinforced concrete and Kimberlite clay brickwork.

The second structural system is the lightweight column and portal frame structure (2). A timber column and beam system is used in the production spaces on the upper ground level. Wood relating to the natural landscape on the end of the building where the building faces the sublime natural landscape. Steel portal frames are used on the Northern side of the building adjacent to the extant rational fabric in a space that starts to indicate the decay of rational form.

The lightweight roof structure (3) consists of polycarbonate and steel sheets over the Northern spaces of the building and weathered standing seam zinc sheets with a timber structure over the southern spaces. These in conjunction with the lightweight column structure in (2) resonate the sublime of exposure.

Figure 7.11. (opposite) The structural logic (Author 2014).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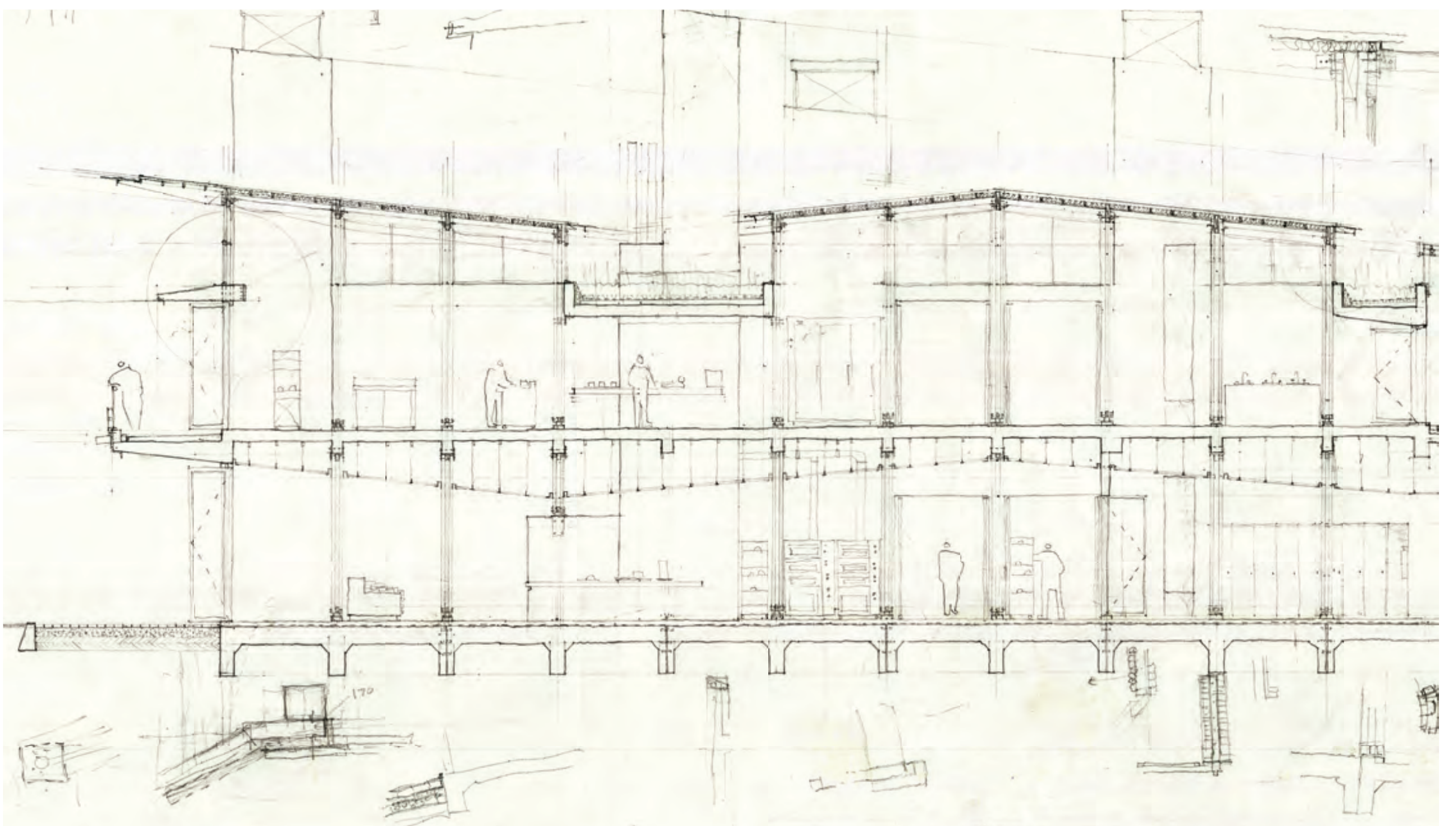
7.4.2 First iteration of the section

Before the first technical presentation a section through the length of the building showing most of the structural systems was drawn on a scale of 1:50 (Figures 7.12 to 7.15). A raft foundation structure with down stand beams is proposed to deal with possible movement in the clay rich soil. Due to the large area of the building which is under the natural ground level, a cavity basement system is proposed.

The baking space (lower left of the section) is a space that represents the sublime of enclosure. The space needs feel as if it has been carved out of the earth. To try and achieve this, the space is given a profiled flush plastered suspended ceiling, creating a cave-like space.

The space above is the packaging space, a space which represents the sublime of exposure. The timber roof and column structure tries to achieve this. The depth of the roof plane is detailed in such a way as to read as thin and lightweight as possible (structure that lies within the primary beam's depth and eaves detailed to become progressively thinner toward the edge). This lightweight roof structure falls to a secondary flat roof, which acts as a gutter and is seen as part of the landscape. Here a planted roof was suggested, to hide waterproofing from the view of visitors in the adjacent buildings.

Comments in the presentation were as follow. It was suggested that the timber roof structure be reconsidered, as it seemed too complicated and results in too many columns. It was also mentioned that a method of modulating the overhead plane of the baking space other than a suspended ceiling should be considered. The ceiling read still reads as a lightweight structure on the section. Finally it was suggested that the planted roof should be reconsidered. It would be hard to maintain the vegetation and it causes some problems with drainage and water catchment.



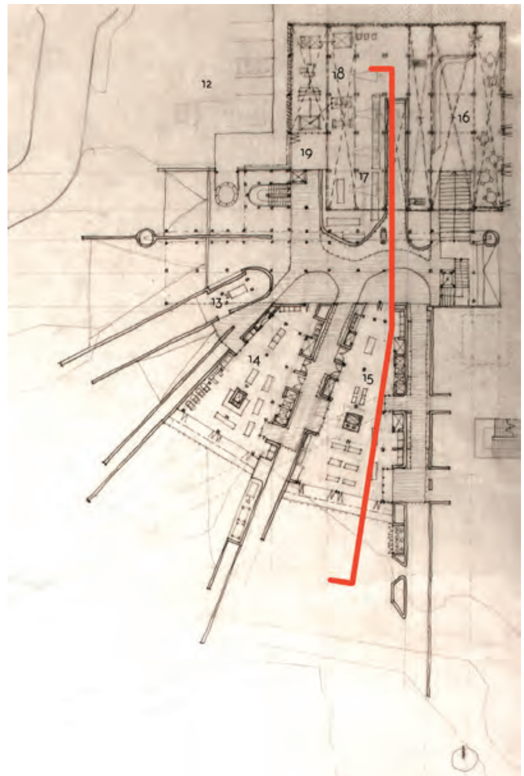
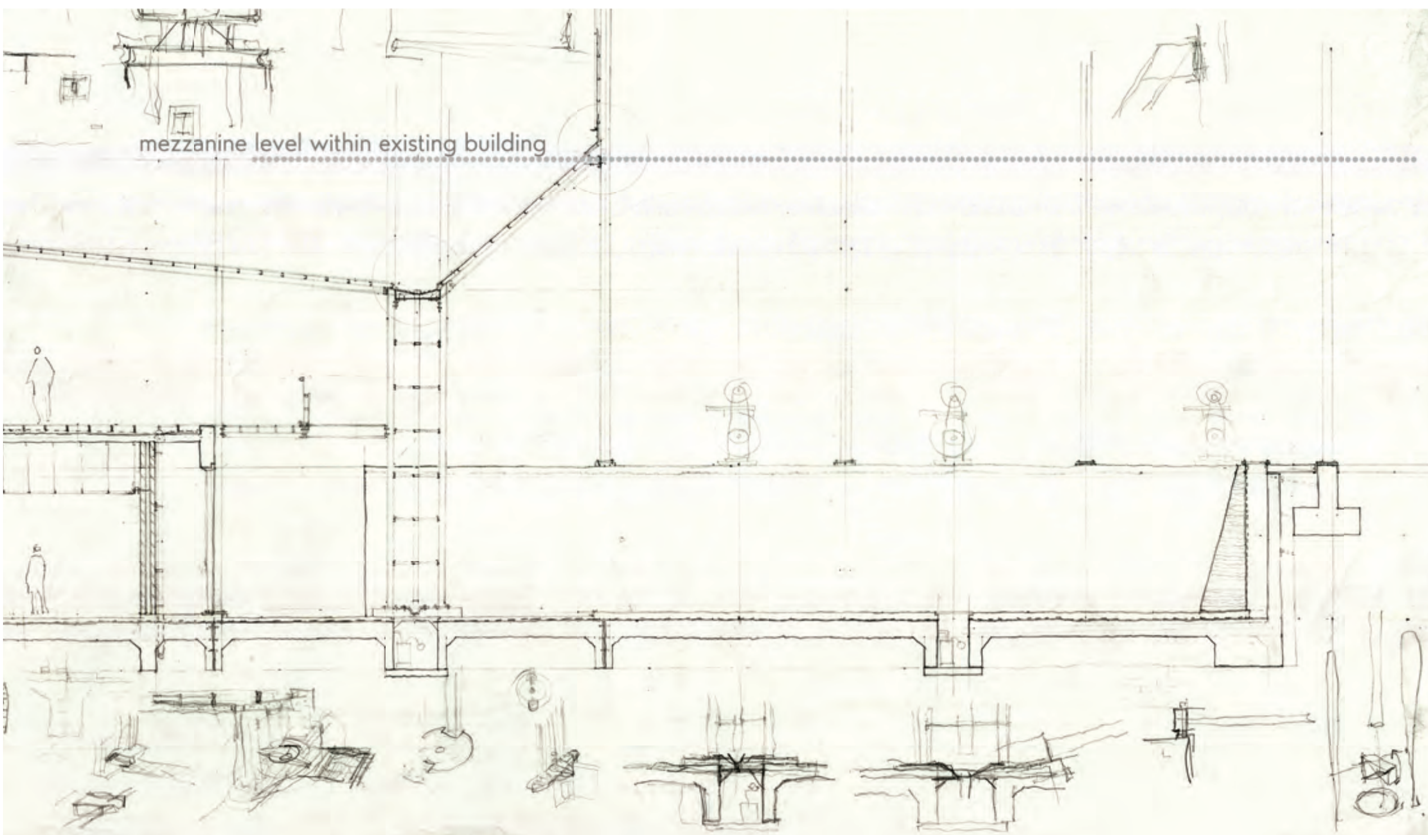


Figure 7.12. (below) Long section at first technical presentation (whole) (Author 2014).

Figure 7.13. (right) The location of the long section (Author 2014).



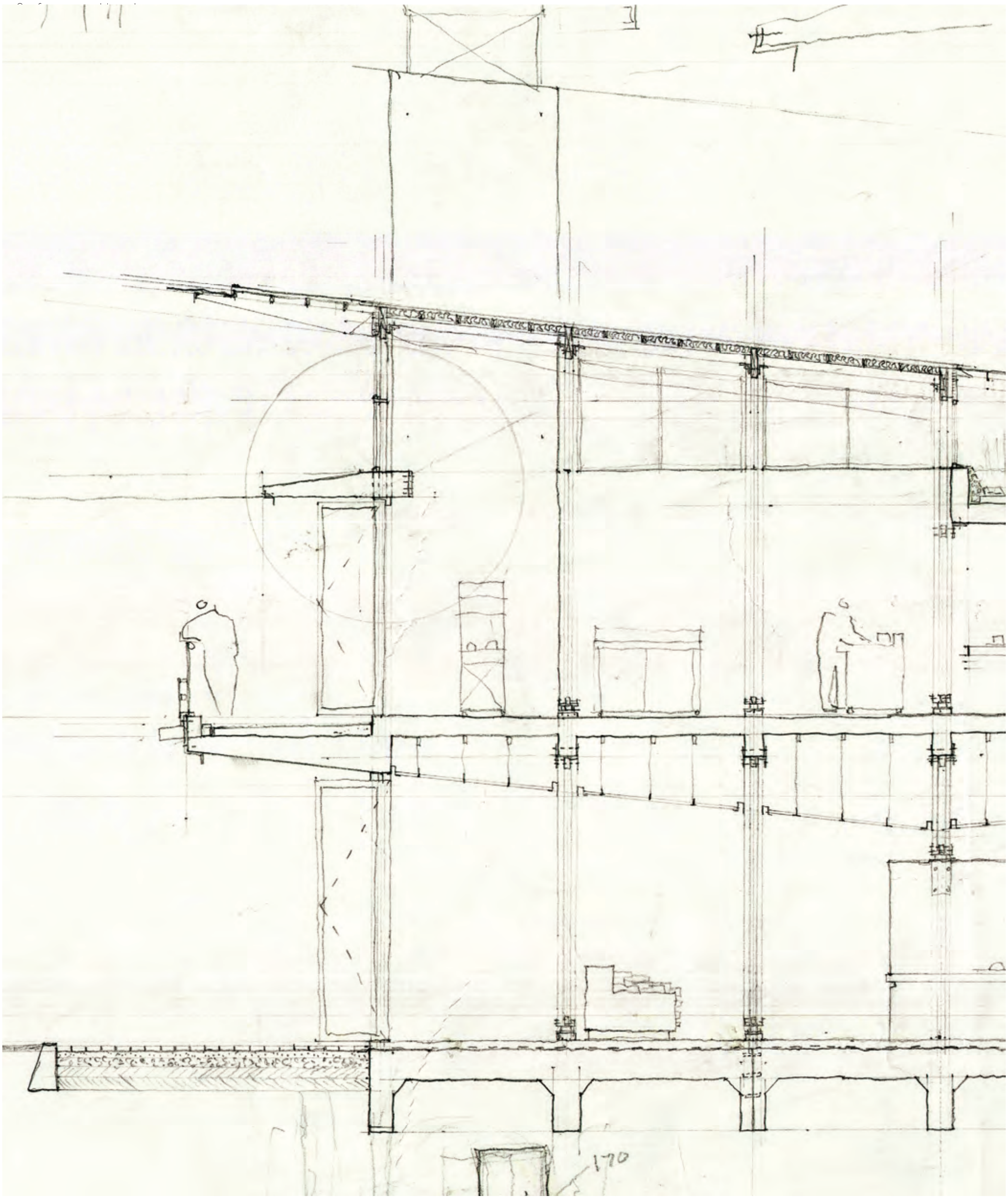
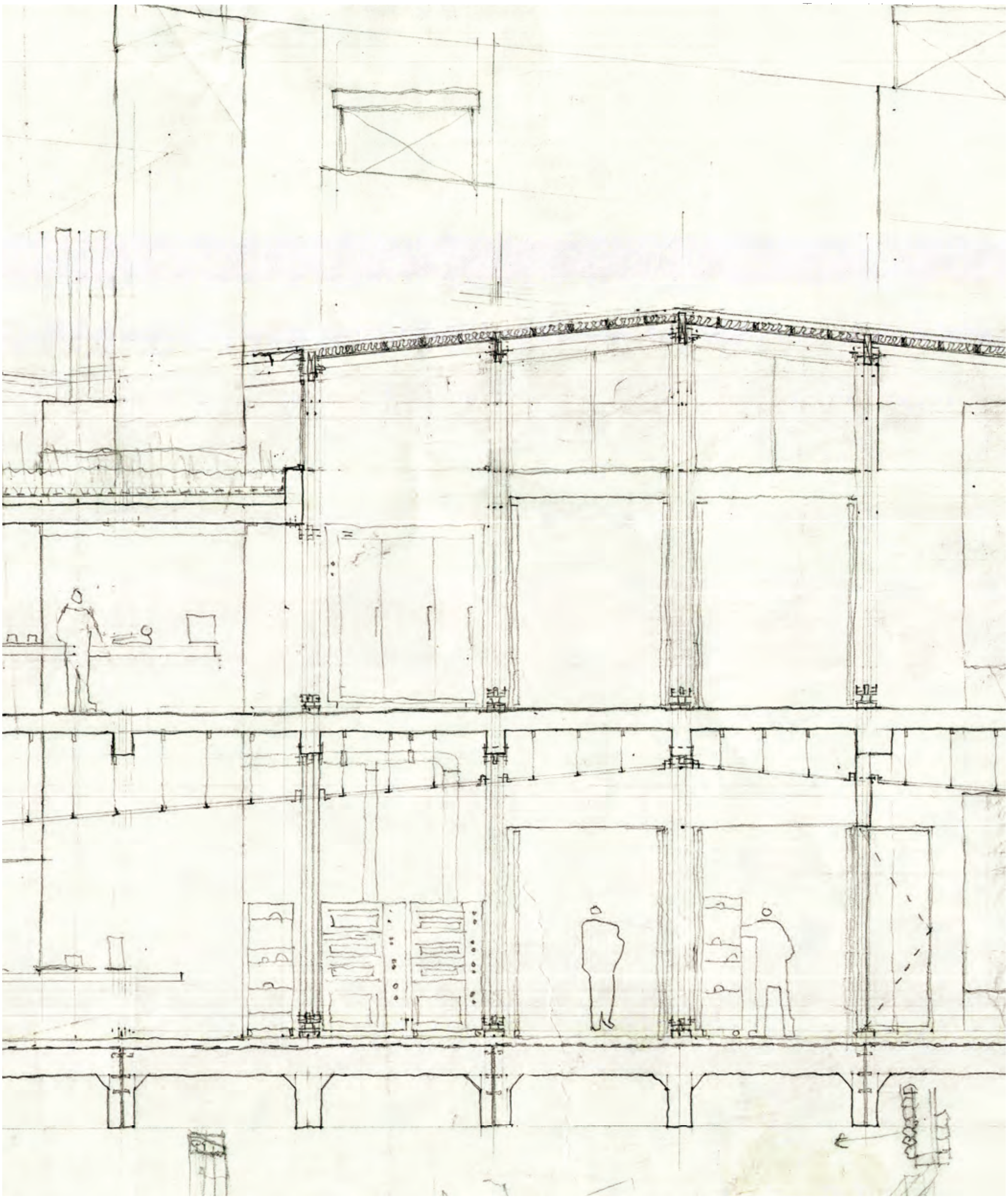


Figure 7.14. Long section at first technical presentation (zoomed part 1) (Author 2014).



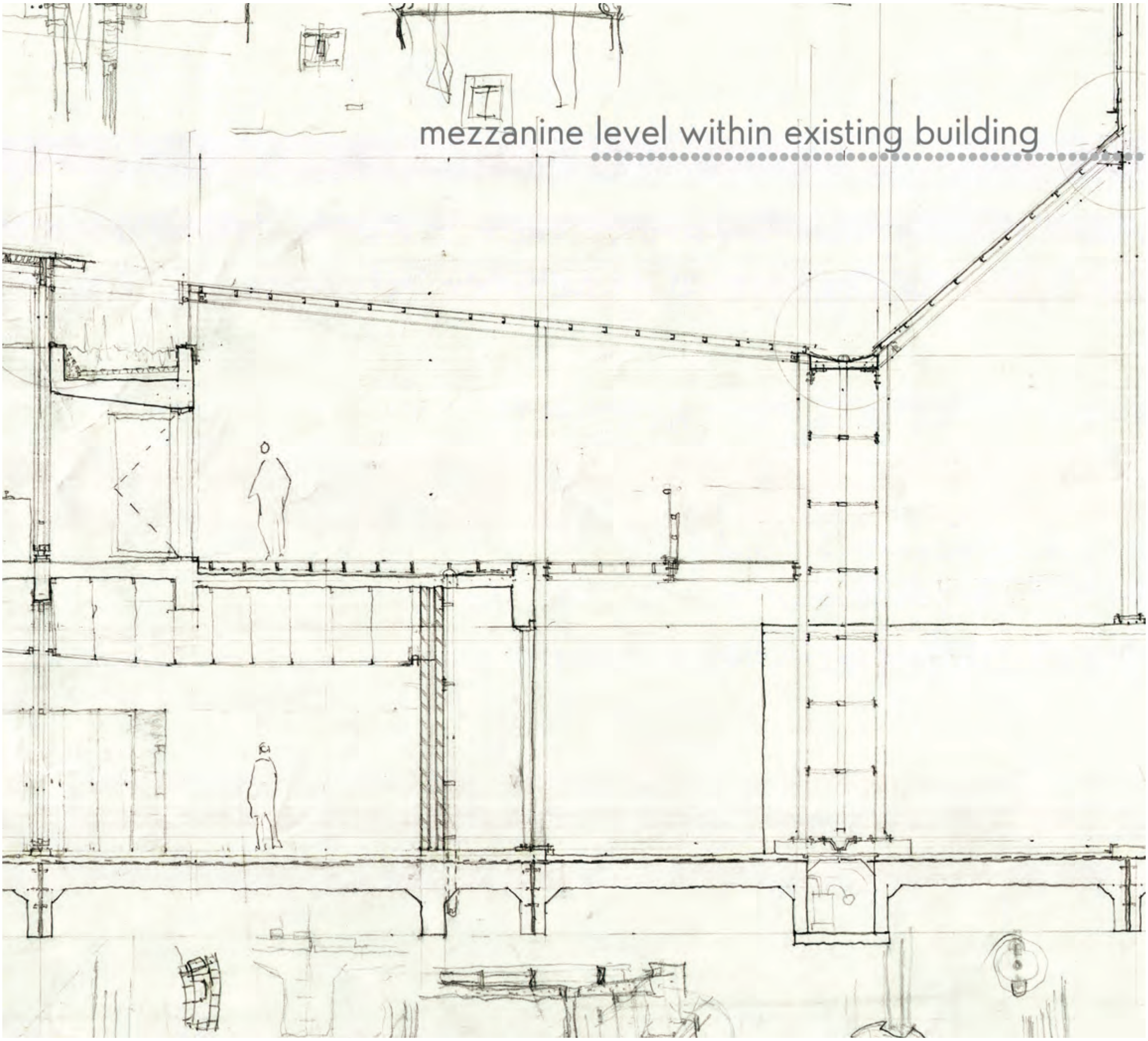
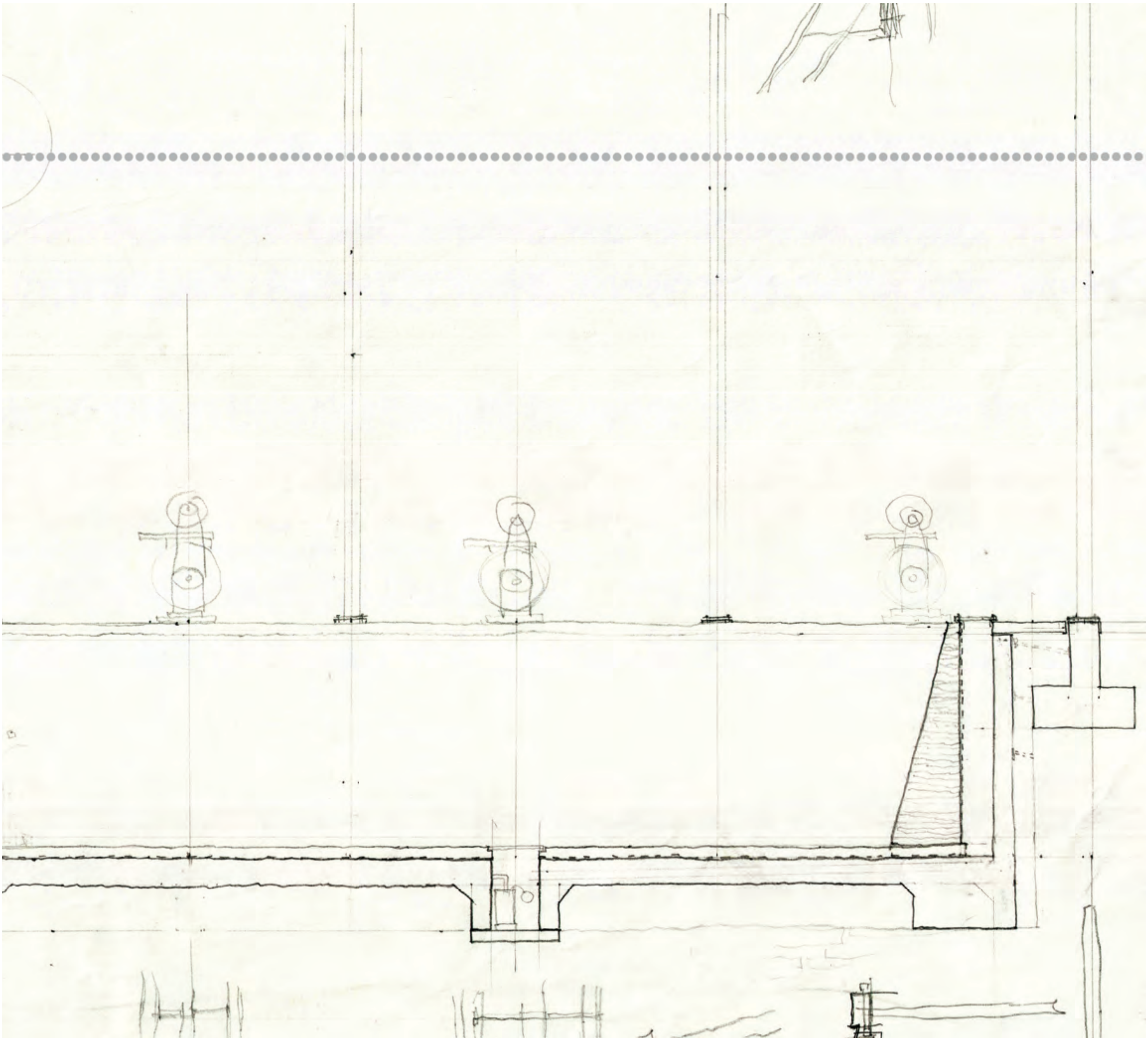


Figure 7.15. Long section at first technical presentation (zoomed part 2) (Author 2014).



7.4.3 Second iteration of the section

For the second technical presentation a second iteration of the section in the first presentation was prepared (Figure x to x). Another section that lies perpendicular to this section was also drawn to further explore the detailing and structural systems and their implication on the spaces of the building (Figure x to x).

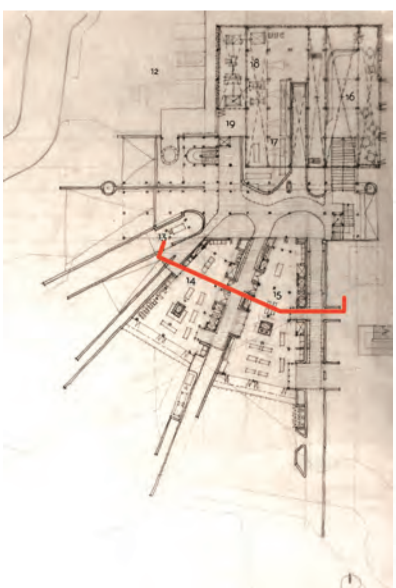
Another method of modulating the overhead was explored. The profile is now created by modulating the depth of the beams of a coffered soffit. The timber roof structure was also simplified and the number of columns reduced. The structure no longer sits within the depth of the primary beams (which now run along the length of the space). The effect of the floating roof is now achieved by wrapping most of the structure with a standing seam cladding system and a tongue and groove board ceiling. Only the primary beams running along the length of the space are visible. This type of structure lends itself more to the concept of the decay of rational, exposed construction in this part of the building. The structural system is hidden and left to the imagination. The eave details were also reconsidered.

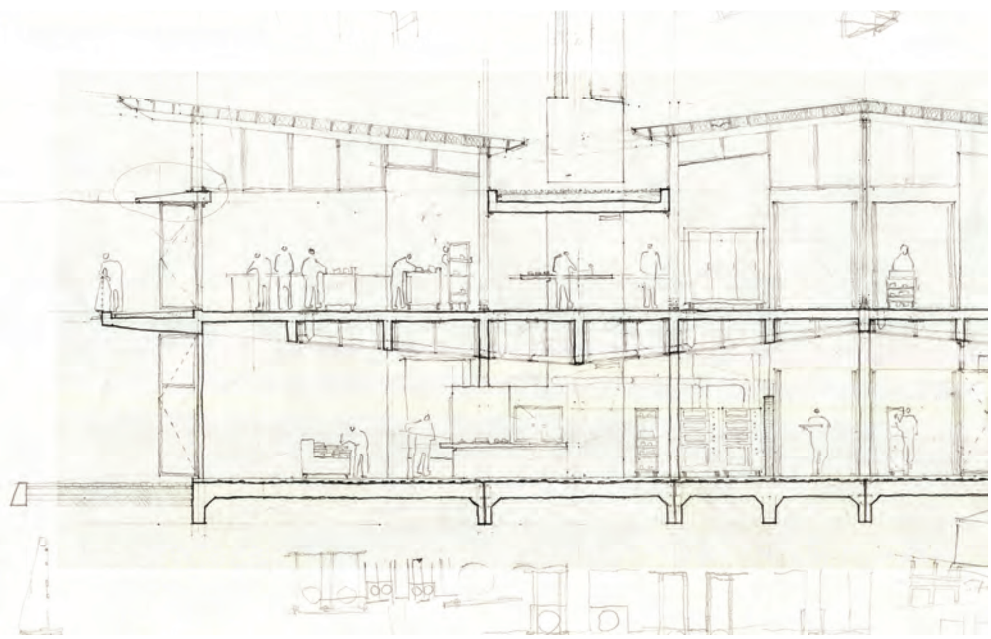
The vegetated flat roof has been replaced with a roof where the waterproofing is covered with coarse gravel. The gravel matches the colour of the Kimberlite clay on site, so it still resonates with the natural landscape.

On the other section the pathways leading into the landscape are shown. Alcoves where the public can view the production process are also shown. The section also goes through one of the light wells designed to draw light into the deeper spaces of the building. It also shows the geothermal cooling system suggested as part of the ventilation system. Protection against Western sun is also shown as vertical louvers on in front of the westernmost clerestory window. The other clerestory windows are either shaded by adjacent roofs of the building, or by the tall adjacent existing structures on site.

Although the profile of the overhead baking space is now created with a heavyweight structure, the economy of doing so was questioned. It was also suggested that the profile of a ceiling can be designed in such a way as to channel hot air into the ventilation system (mentioned in the next part of this chapter). The sequence of construction of elements like the light well was also questioned.

These issues were taken into consideration in the further development of the design towards the final exam, thus the work shown in this document will still be improved upon further.





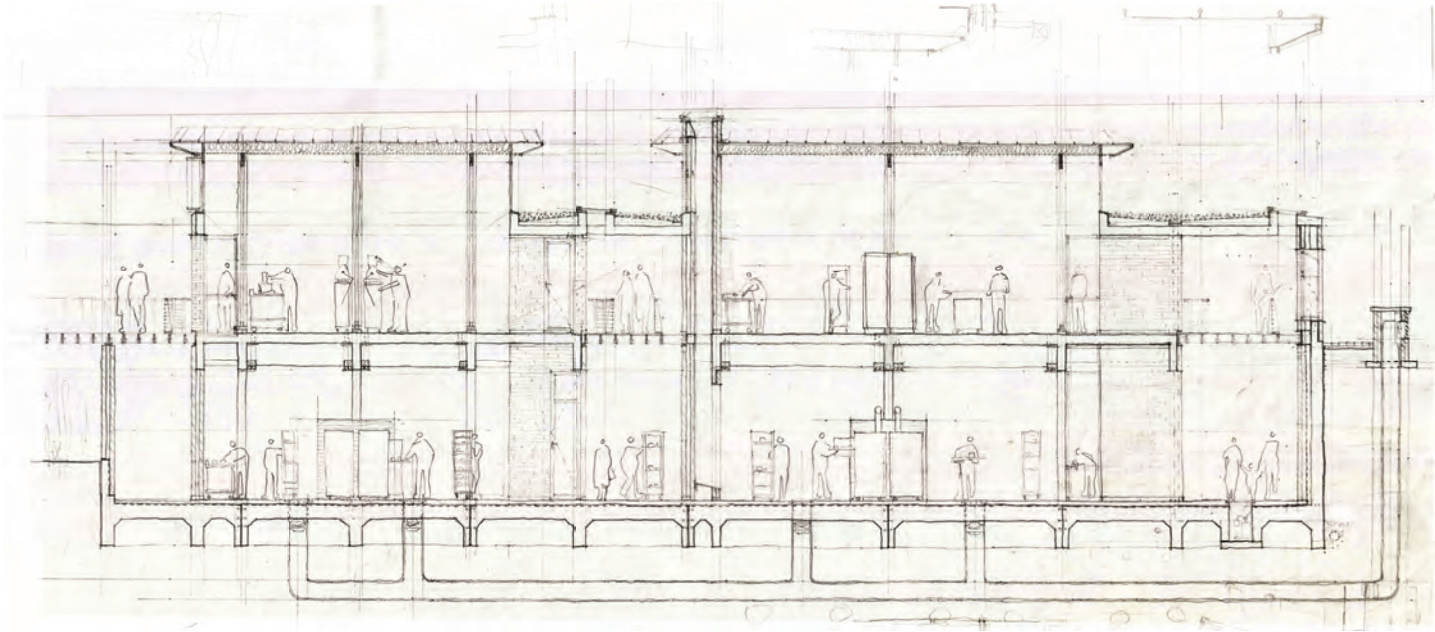
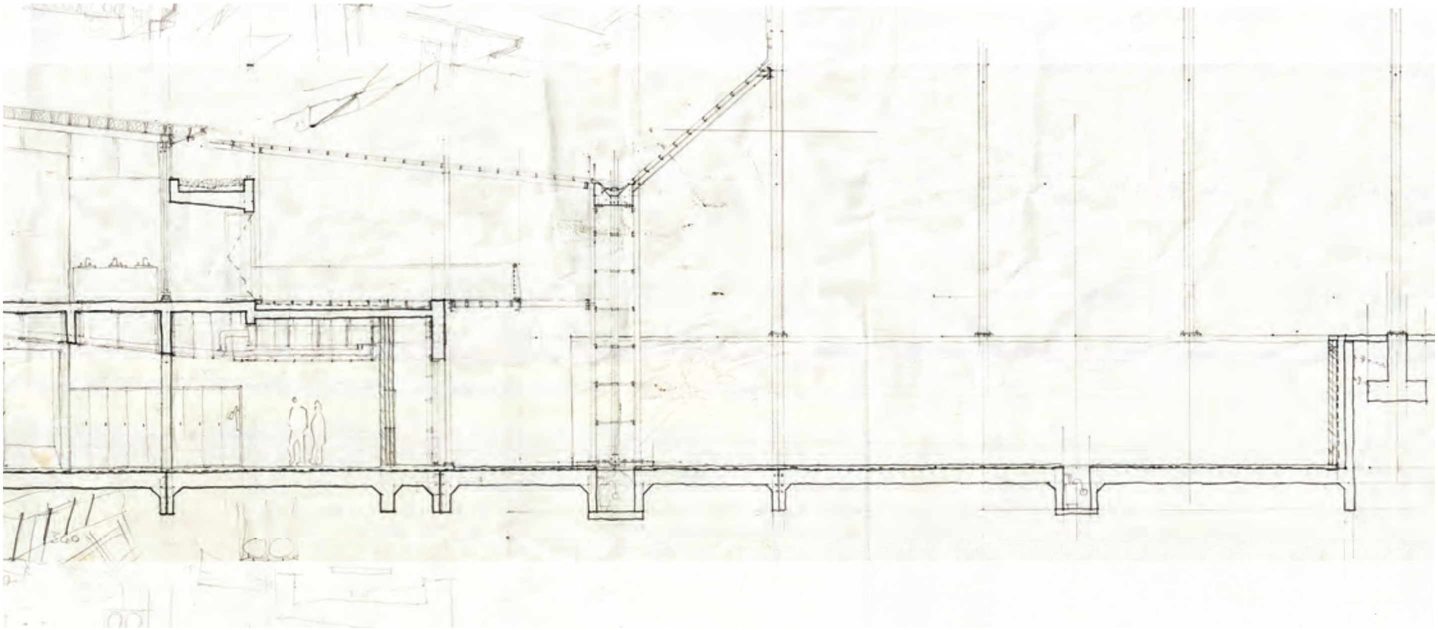


Figure 7.16. (below) Long section at second technical presentation (Author 2014).

Figure 7.17. (above) Cross section at second technical presentation (Author 2014).

Figure 7.18. (opposite) The location of the cross section (Author 2014).



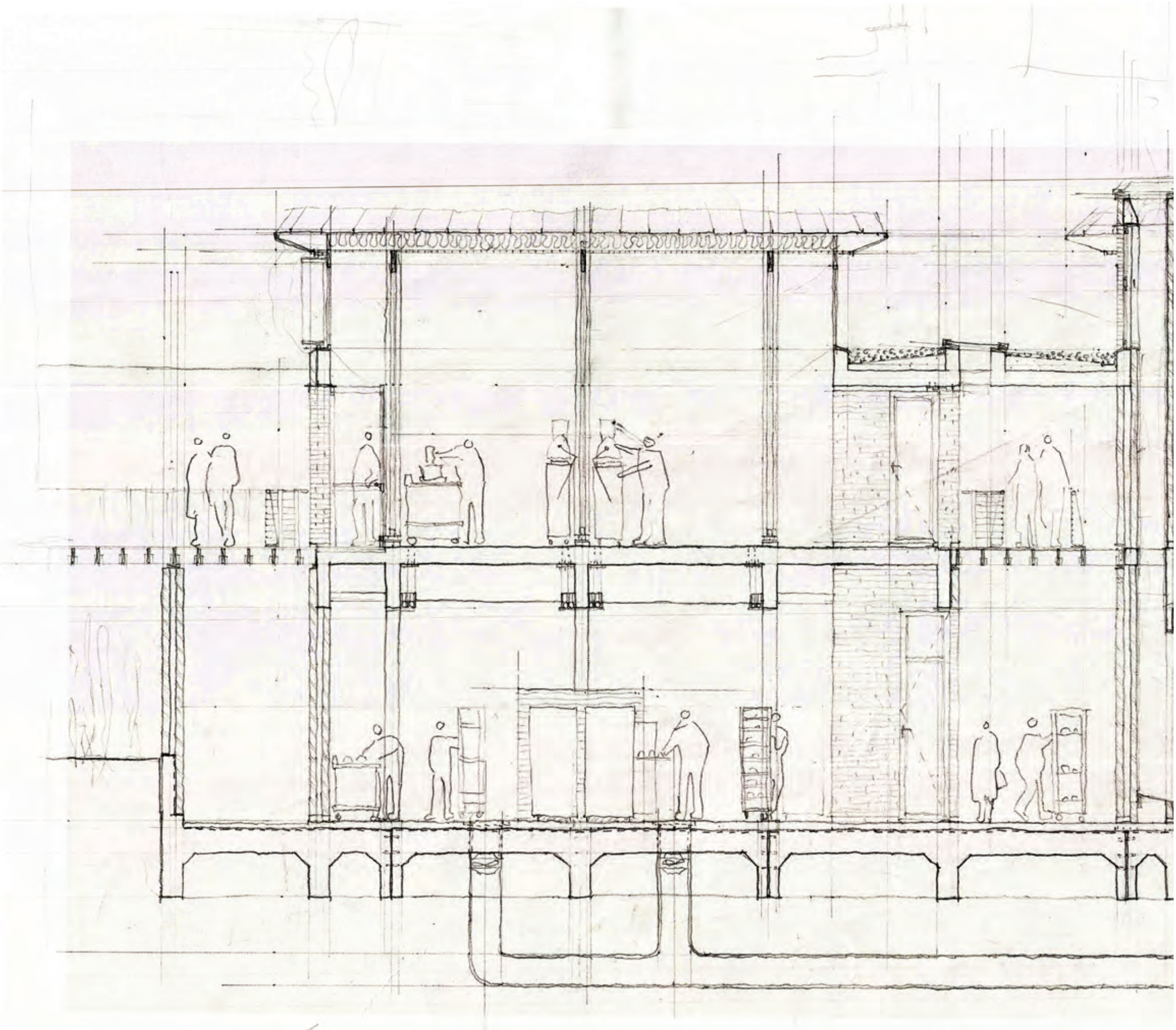
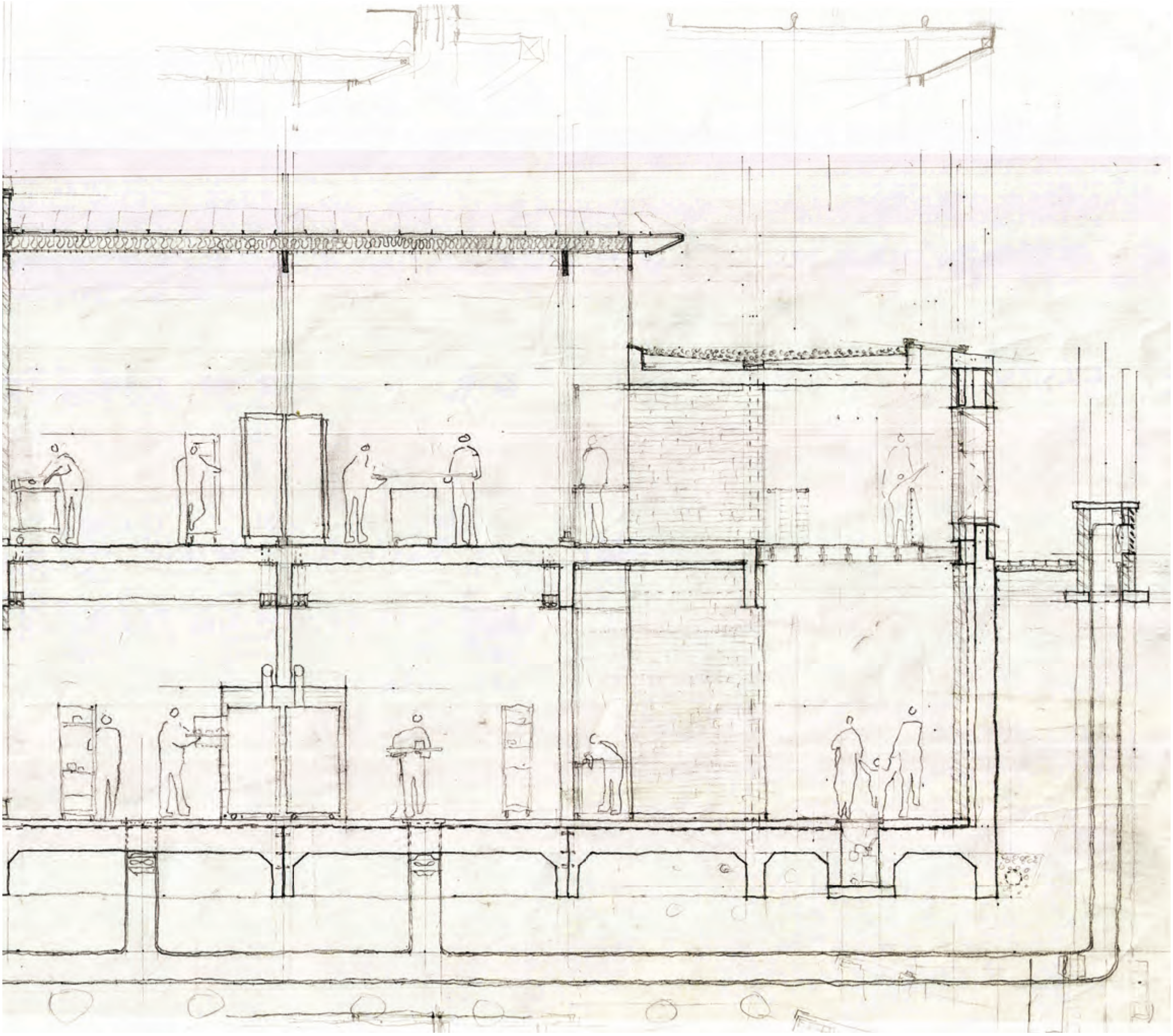


Figure 7.19. Cross section at second technical presentation (zoomed) (Author 2014).



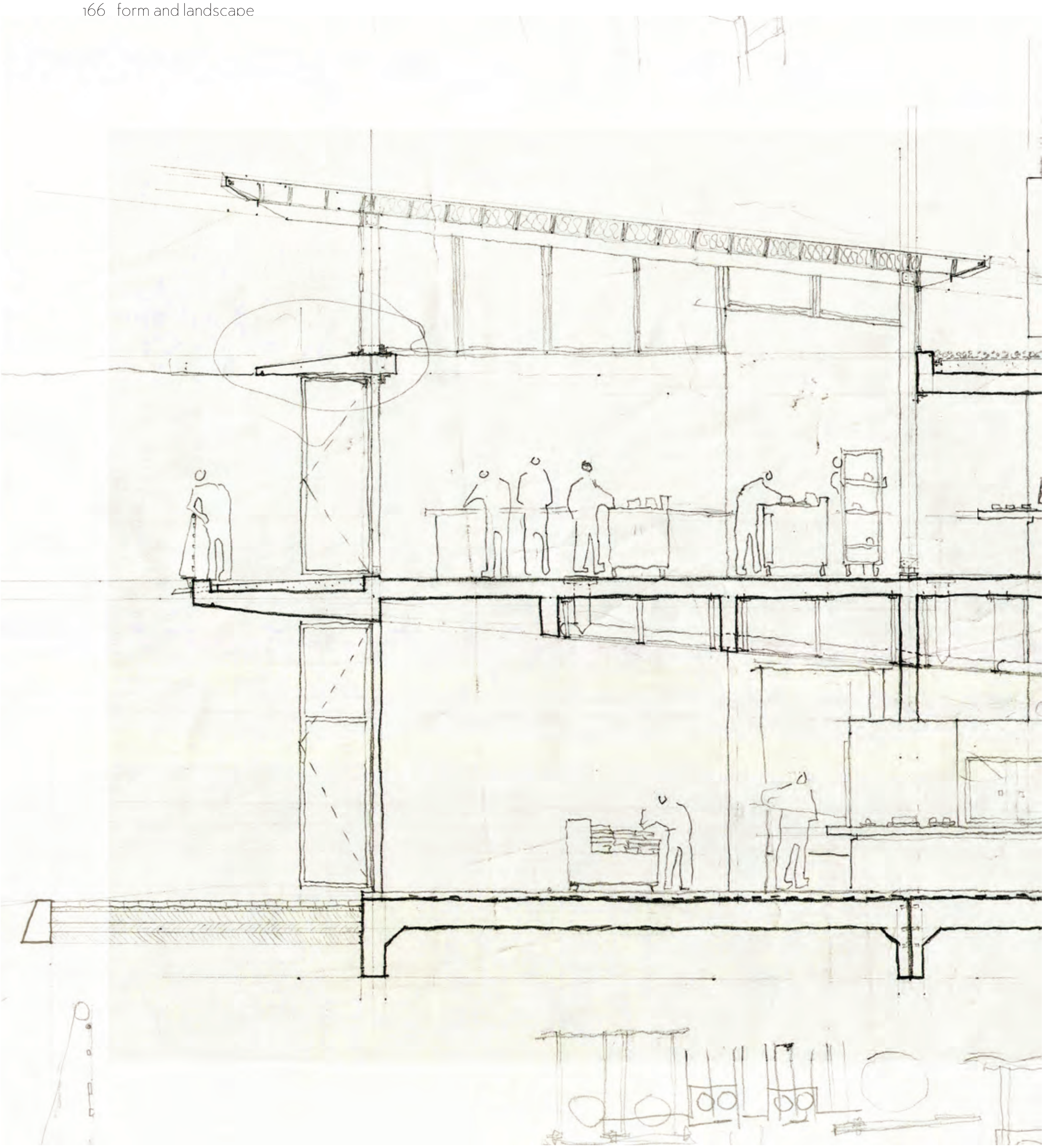
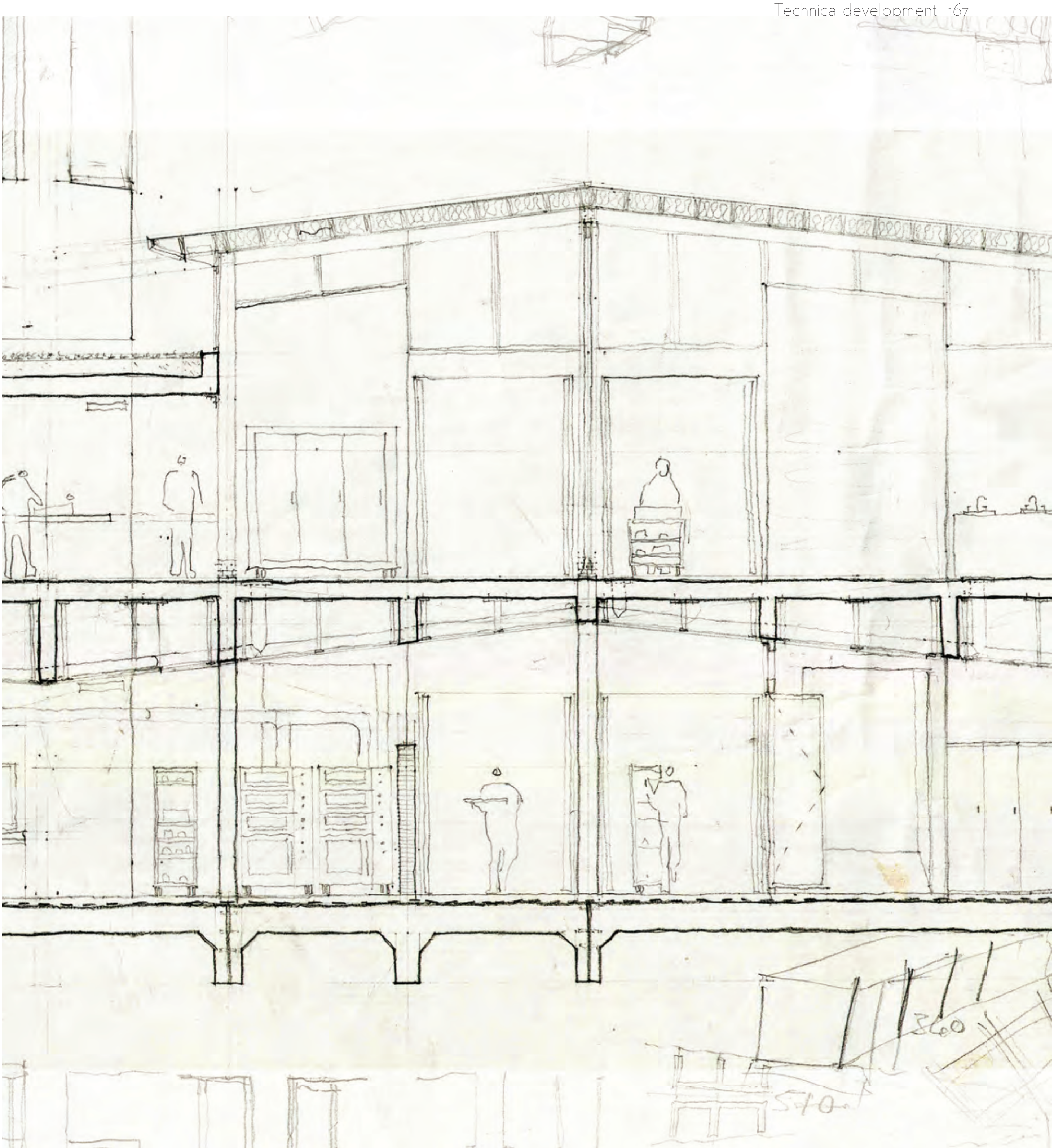


Figure 7.20. Long section at second technical presentation (zoomed part 1) (Author 2014).


360
570

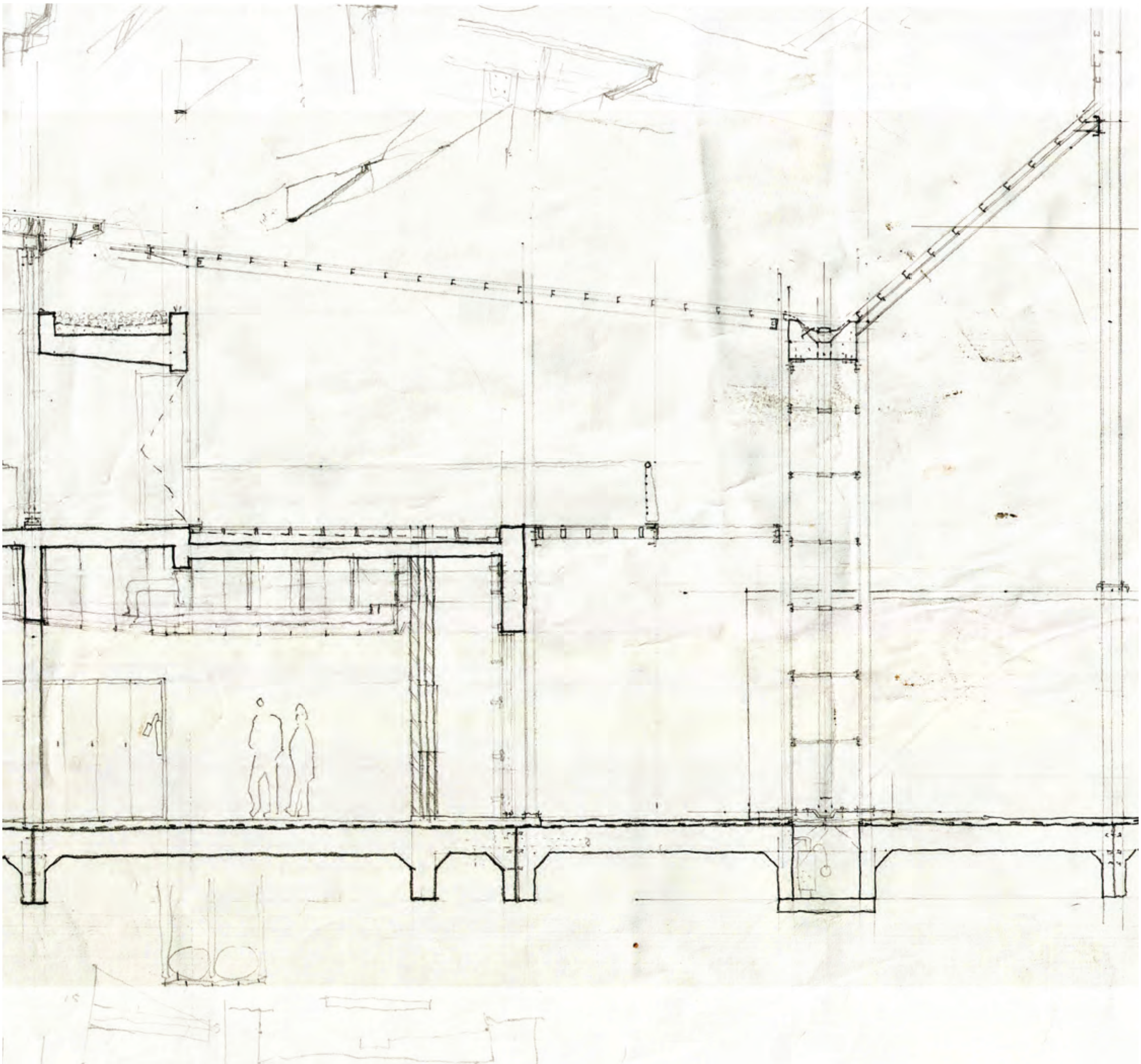
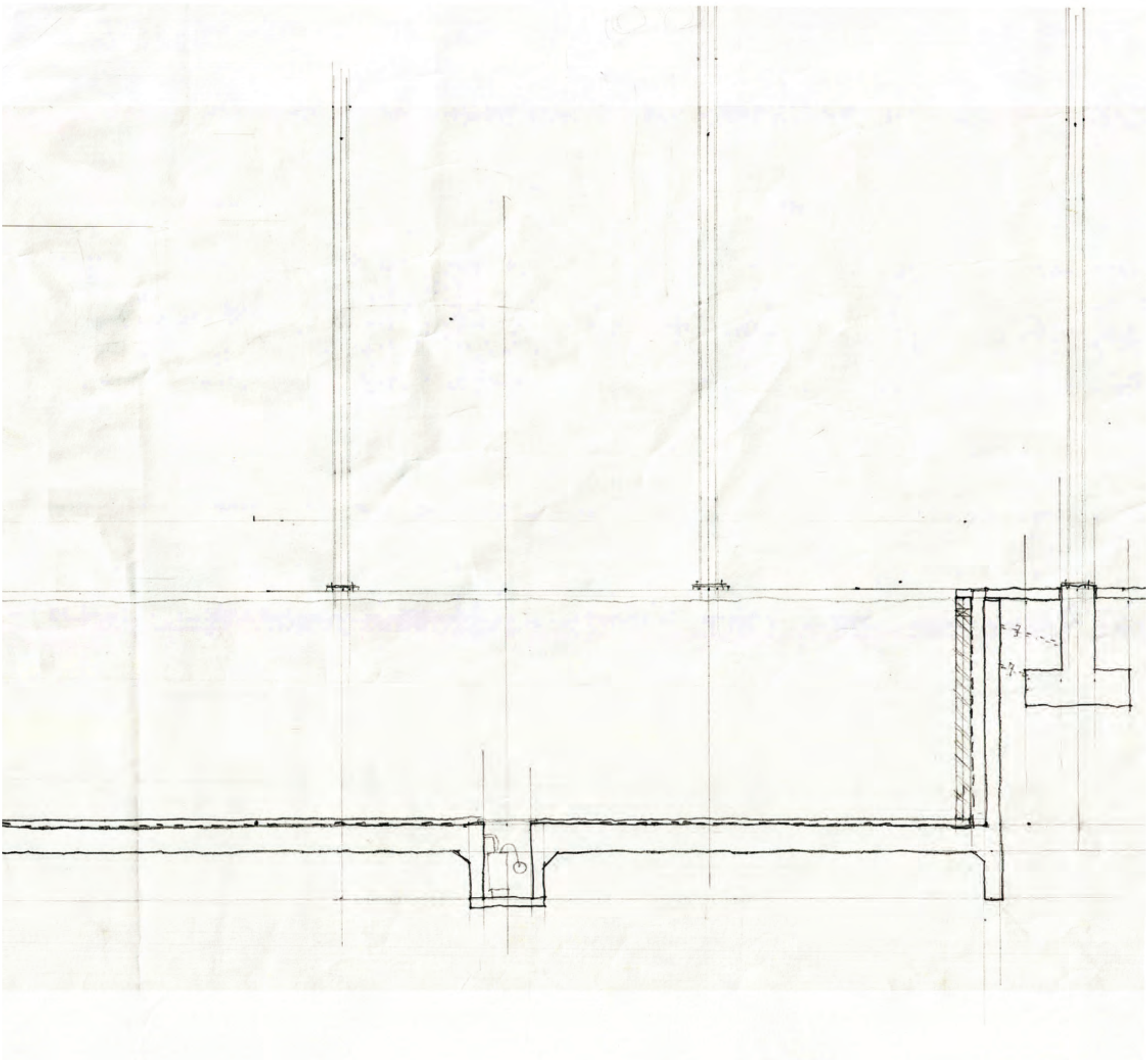


Figure 7.21. Long section at second technical presentation (zoomed part 2) (Author 2014).



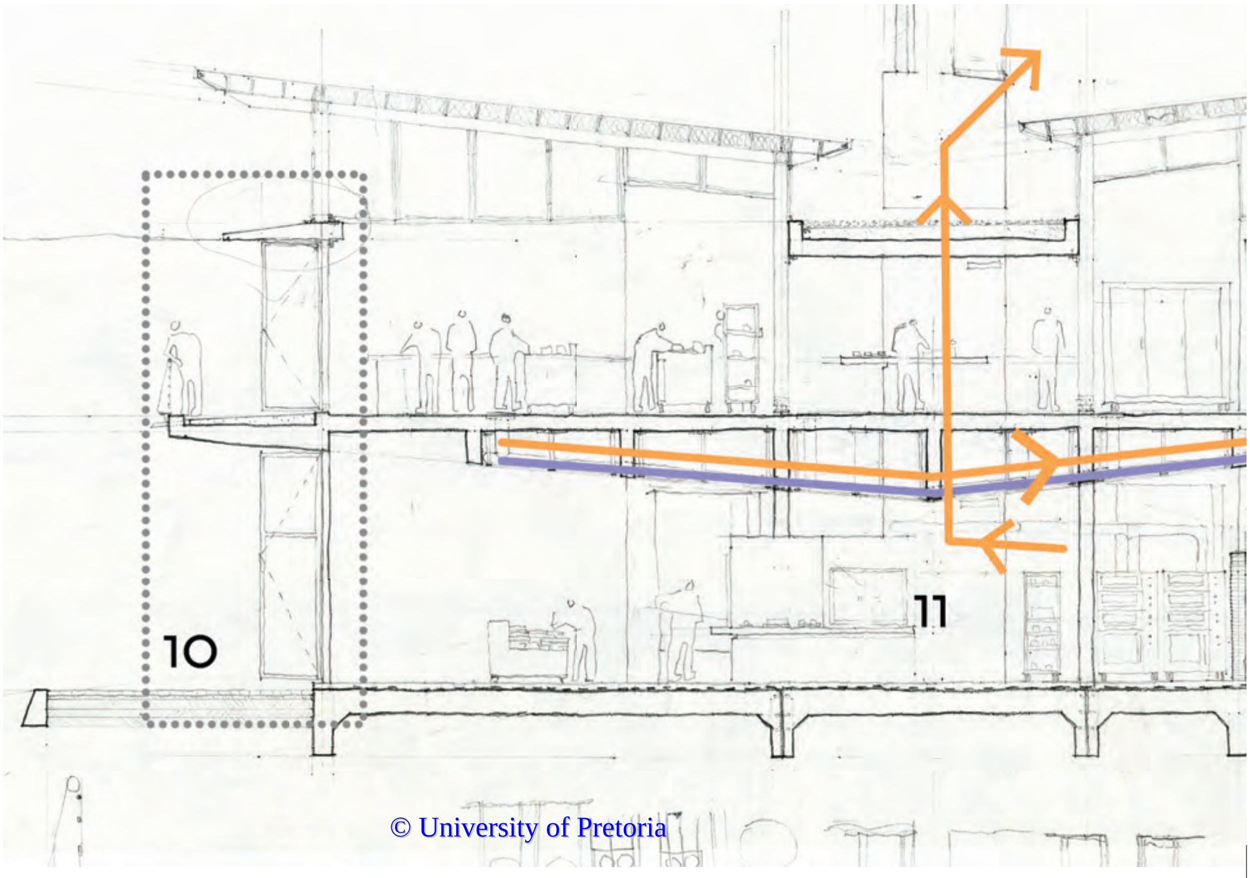
7.5 Ventilation heating and cooling

It is proposed that the ventilation, heating and cooling in the spaces be handled with a combination of passive and active systems. Although it would be possible to regulate temperatures and ventilation with passive systems alone if the spaces just had to be within comfort levels, the operating hours of the building (which start at about 4 a.m.) and specific conditions related to the program (proofing) make correct air change rates and temperatures difficult to achieve with these alone.

Figure 7.22 and 7.23 show the ventilation and temperature control strategy on section in the building. The first passive system used is geothermal cooling pipes. Fresh air is drawn in through an inlet vent (1) with the use of in-line DC fans situated through the length of the pipe (2). These fans run at different speeds to ensure a similar air pressure throughout its length and to ensure the air is mixed and all of it comes into contact with the cool sides of the pipe. Because the soil at this depth of the building is at a constant temperature, year round the outlet temperature of the cooled (or in winter heated) air is about 18 degrees Celsius. This fresh cool air is fed through the floor of the spaces in the building (3).

Fresh air can also be supplied by the ceiling hung air handling unit (8) through ducts in the ceiling plenum (4). These ceiling hung air handling units are designed to be quiet and to fir into most ceiling plenums (most units are about 540mm deep) (Daikin). This air handling unit also supplies fresh air through floor outlets into the upper spaces and removes stale air from the lower spaces (5). It can also regulate the temperature in the spaces in conjunction with the passive systems. The air handling unit recycles most of the stale air to be recirculated, but additional fresh ait and an exhaust outlet can be located in the space open covered space adjacent to the production spaces (9).

Stale air is also removed from the spaces by windows located high up in the spaces (6 and 7). Additionally the folding stacking doors on the South side of these spaces can be opened (10). The wood fired ovens also fuel a stack which can supplement the removal of stale air (11).



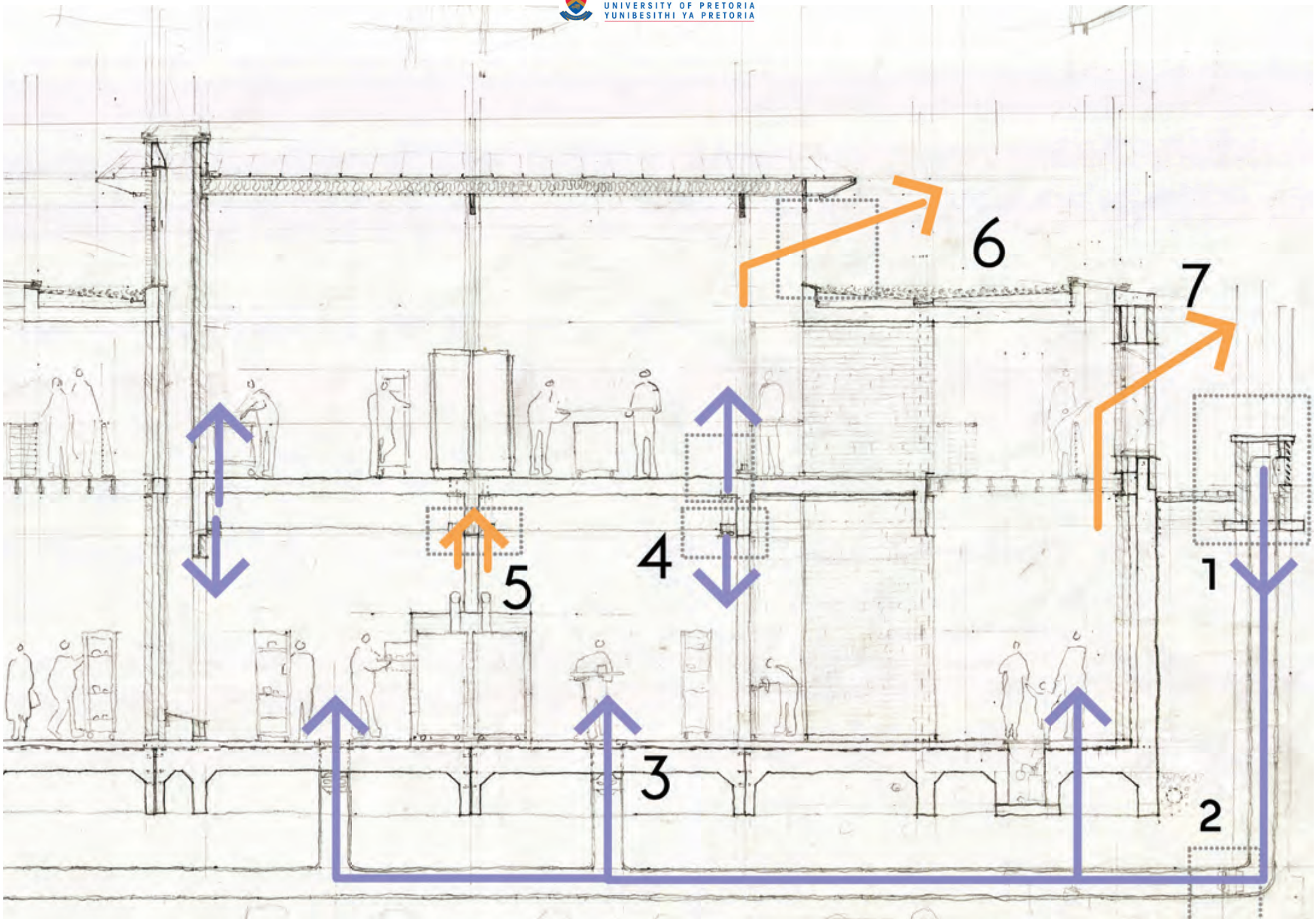
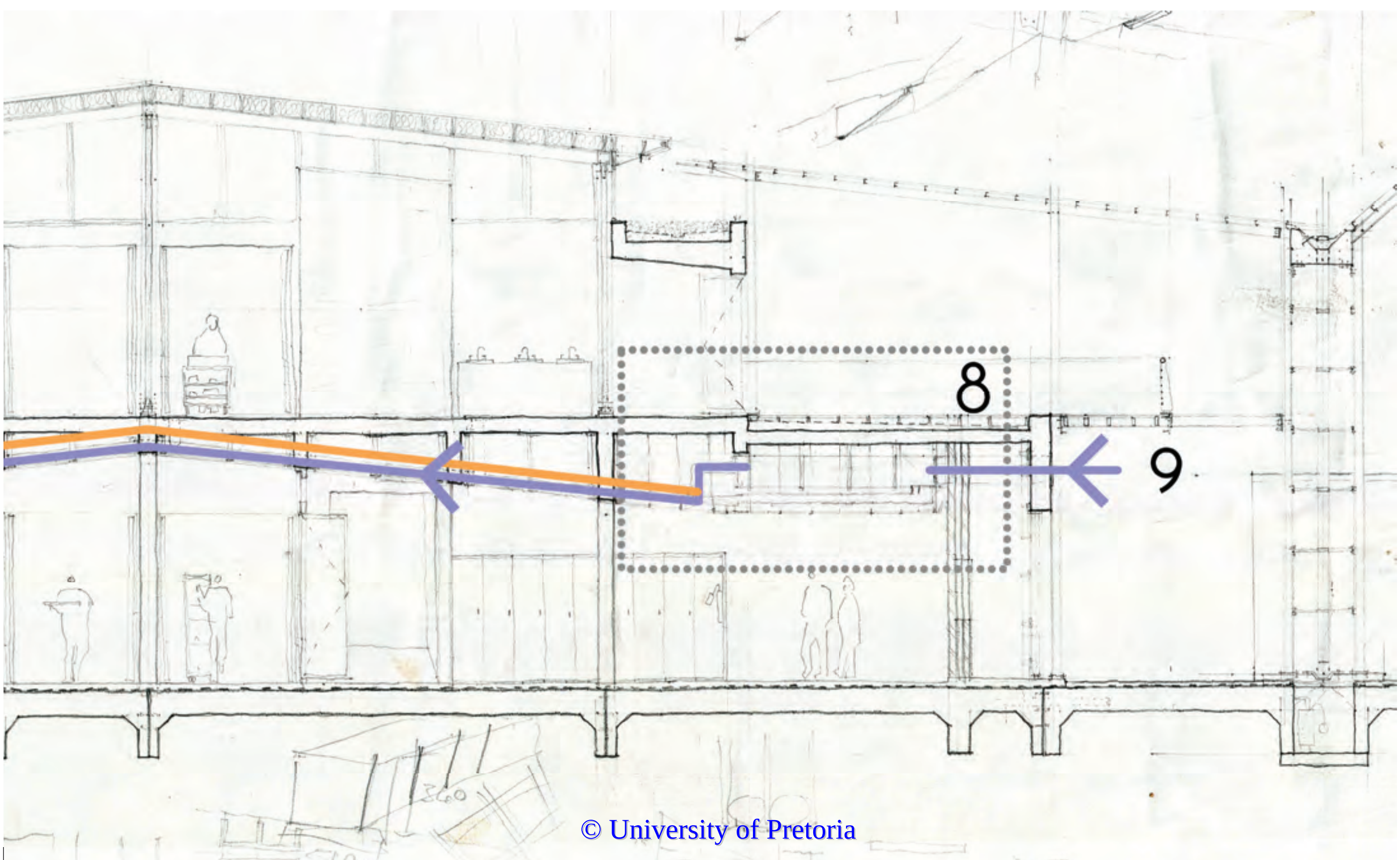


Figure 7.22. (above) Ventilation strategy 1 (Author 2014).

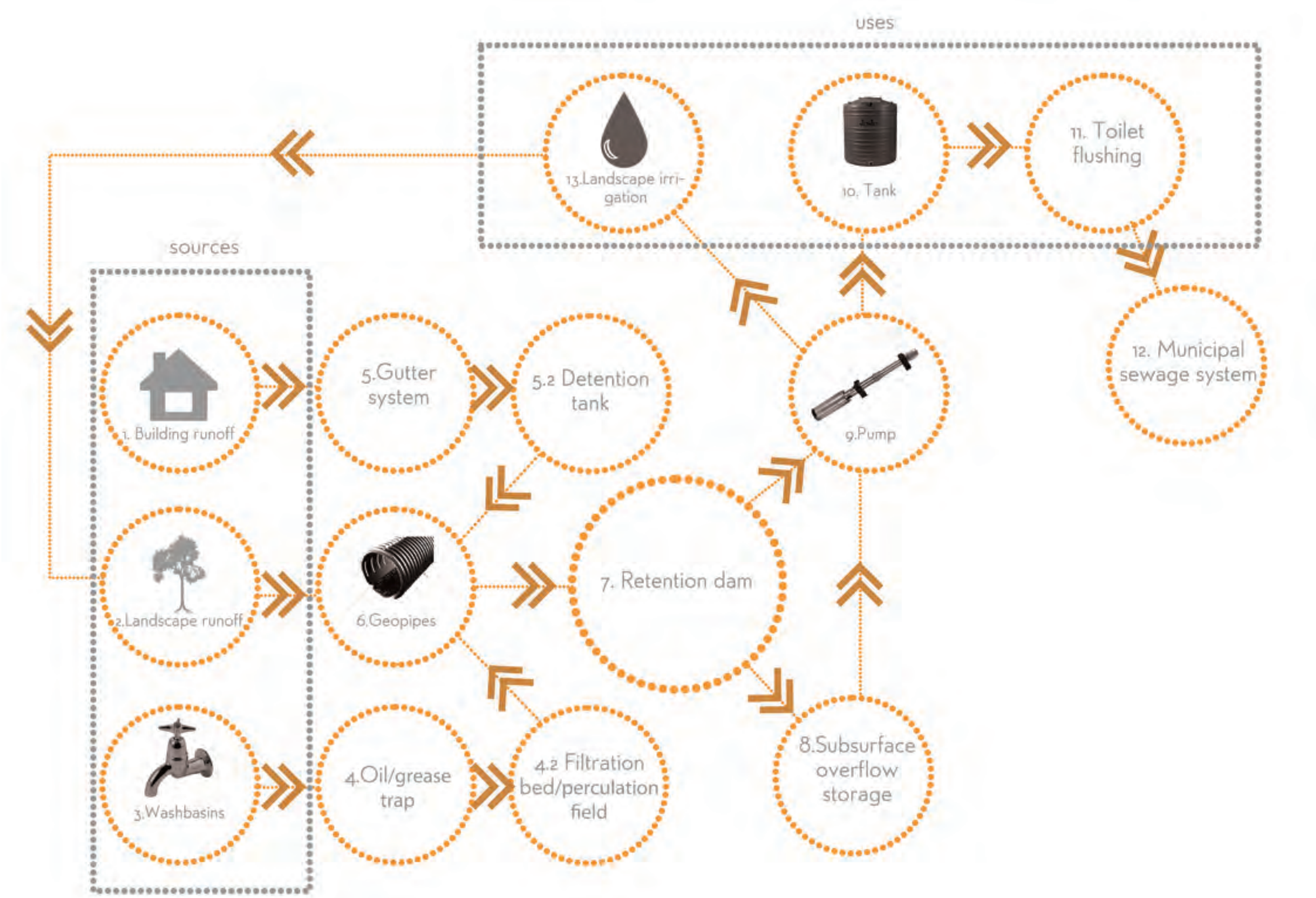
Figure 7.23. (below) Ventilation strategy 2 (Author 2014).



7.6 Water strategy

Figure 7.24 and 7.25 show the water runoff strategy for the building. Figure 7.29 contains a water budget analysis. Water is sourced from building runoff, irrigation runoff and washbasins. The runoff from the building goes through the building's drainage system (Figure 7.25) to a detention tank located below the floor slab. From here the water enters a series of 110mm outlet pipes that fall to a retention dam (Figure 7.27). The water from the washbasins first passes through an oil trap which leads to a filtration bed (Figure 7.28) before it runs to the geopipe system.

This retention dam contains wetland planting, which filter remaining impurities from the water. Due to the size of the dam, and additional subsurface overflow tank with roughly the same capacity as the dam is required (Figure 7.27). From here the water needed for flushing the WCs is pumped, using a solar powered pump that is submerged in the dam, is pumped into a raised water tank to create the required pressure head. From here the WCs drain into the municipal sewage system. Water stored in the dam and overflow tank is also used for irrigating the vegetation on site.



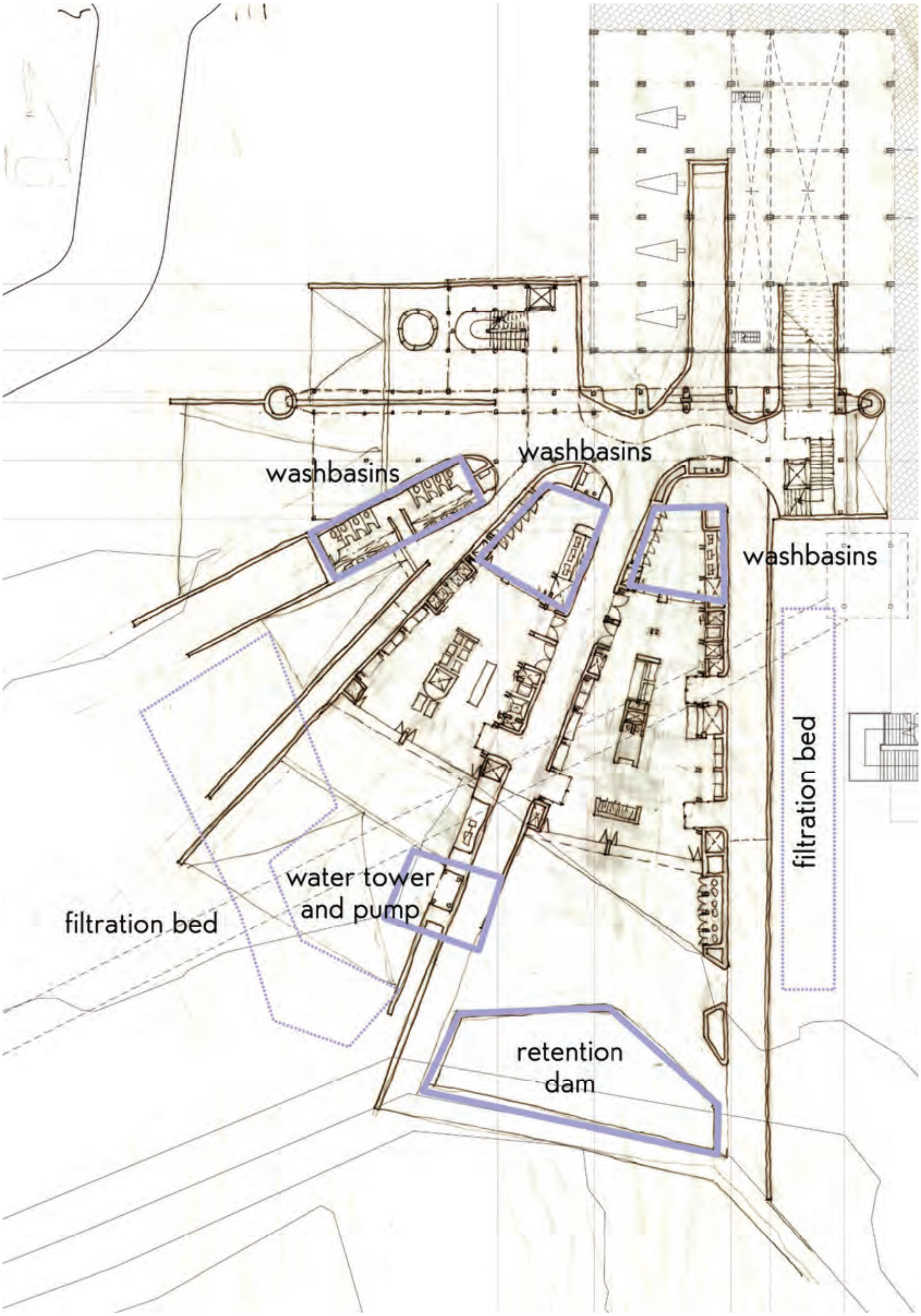


Figure 7.24. (opposite) The water strategy diagram (Author 2014).

Figure 7.25. Elements of the water strategy on plan (Author 2014).

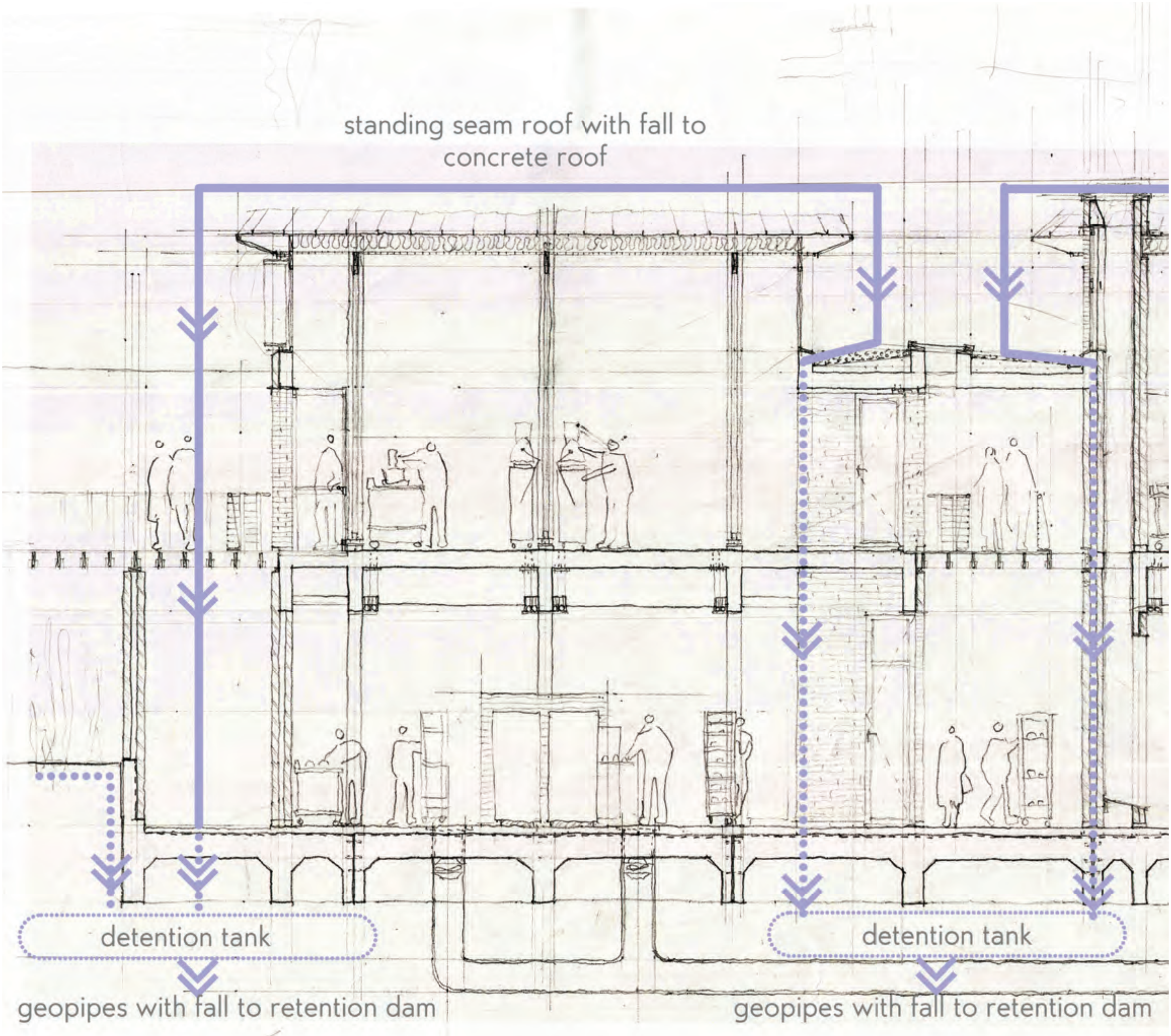
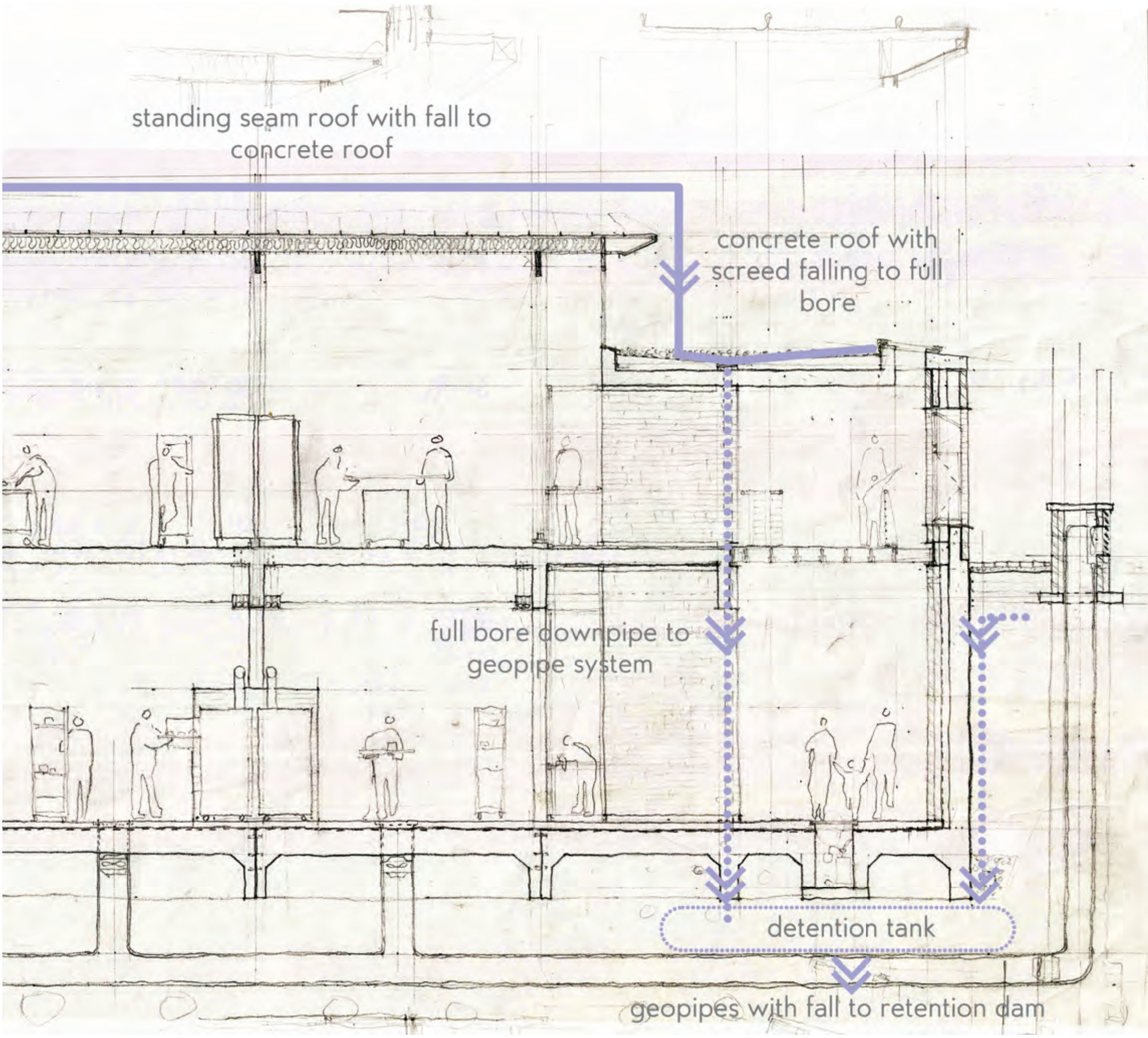


Figure 7.26. Water drainage strategy (Author 2014).


standing seam roof with fall to concrete roof
concrete roof with screed falling to full bore
full bore downpipe to geopipe system
detention tank
geopipes with fall to retention dam

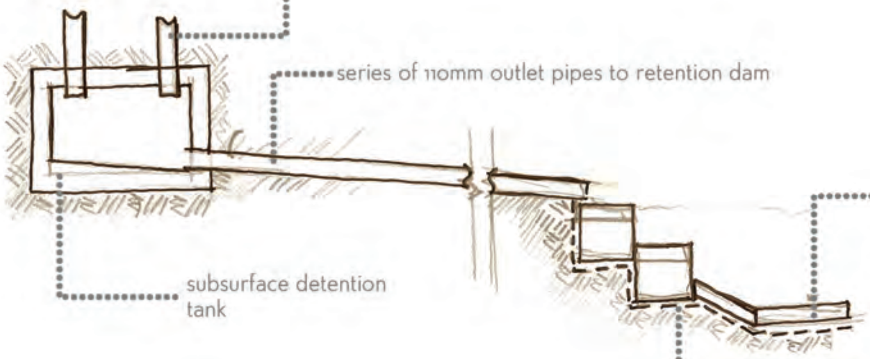


Figure 7.27. Diagram showing the water strategy after it leaves the downpipes (Author 2014).

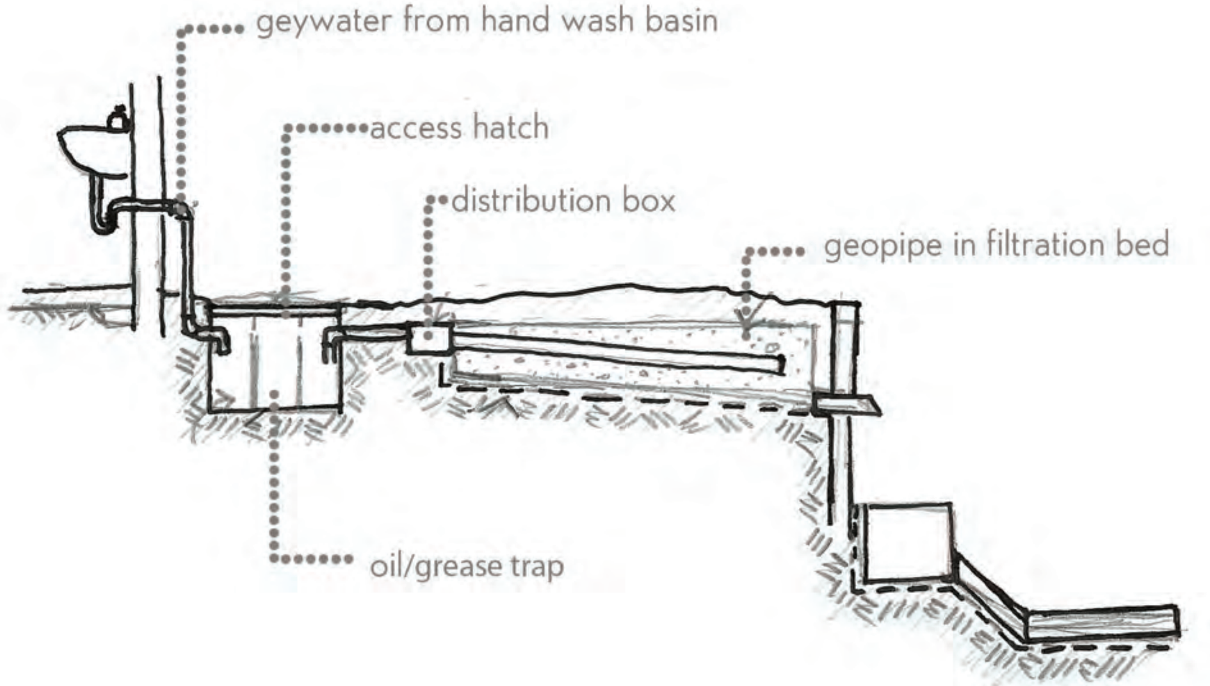


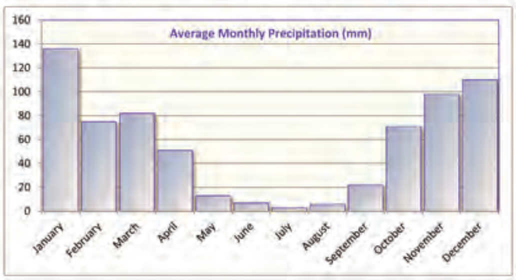
Figure 7.28. The water strategy for cleaning the greywater from the washbasins (Author 2014).

1. Climate Data

Place: Pretoria

Position: 25°44'S, 28°11'E
Height: 1330m
Period: 1961-1990

	MONTH	Temperature: Highest Recorded	Temperature: Average Daily maximum	Temperature: Average Daily Minimum	Temperature: Lowest Recorded	Precipitation: Average Monthly (mm)	Precipitation: Average number of Days >= 1mm	Precipitation: Highest 24hr rainfall (mm)
1.	January	36	29	18	8	136	14	160
2.	February	36	28	17	11	75	11	95
3.	March	35	27	16	6	82	10	84
4.	April	33	24	12	3	51	7	72
5.	May	29	22	8	-1	13	3	40
6.	June	25	19	5	-6	7	1	32
7.	July	26	20	5	-4	3	1	18
8.	August	31	22	8	-1	6	2	15
9.	September	34	26	12	2	22	3	43
10.	October	36	27	14	4	71	9	108
11.	November	36	27	16	7	98	12	67
12.	December	35	28	17	7	110	15	50
	YEAR	36	25	12	-6	674	87	160

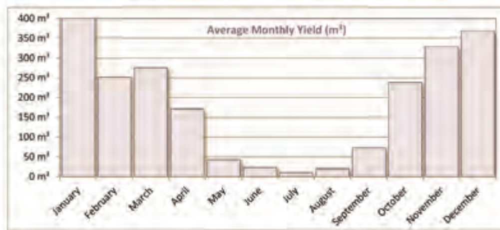


2. Yield

Yield (m³) = P x A x C (Where P=precipitation (m), A=area (m²), and C=run-off coefficient)

Area of Catchment: (Per surface)	Area (m²)	Run-off Coefficient
Roofing	1 863,00 m²	0,9
Paving	777,00 m²	0,8
Veldgrass	1 147,00 m²	0,3
Lawn	231,00 m²	0,4
Planting	855,00 m²	0,3
Gravel	524,00 m²	0,7
TOTAL:	5 397,00 m²	0,62

	MONTH	Precipitation Average Monthly (mm)	Area	Run-off Coefficient	Yield P(m) x A(m²) x C
1.	January	136 mm	5 397 m²	0,62	457 m³
2.	February	75 mm	5 397 m²	0,62	252 m³
3.	March	82 mm	5 397 m²	0,62	275 m³
4.	April	51 mm	5 397 m²	0,62	171 m³
5.	May	13 mm	5 397 m²	0,62	44 m³
6.	June	7 mm	5 397 m²	0,62	24 m³
7.	July	3 mm	5 397 m²	0,62	10 m³
8.	August	6 mm	5 397 m²	0,62	20 m³
9.	September	22 mm	5 397 m²	0,62	74 m³
10.	October	71 mm	5 397 m²	0,62	238 m³
11.	November	98 mm	5 397 m²	0,62	329 m³
12.	December	110 mm	5 397 m²	0,62	369 m³
	YEAR	674 mm	5 397 m²	0,62	2 263 m³



3. Demand (Irrigation and Domestic)

IRRIGATION DEMAND

	Planting Area (m²)	Irrigation Depth per week (m)	Irrigation Depth per month (m)	IRRIGATION DEMAND (m³)
January	1 080 m²	0,040 m	0,177 m	191 m³
February	1 080 m²	0,040 m	0,160 m	173 m³
March	1 080 m²	0,040 m	0,177 m	191 m³
April	1 080 m²	0,030 m	0,129 m	139 m³
May	1 080 m²	0,020 m	0,089 m	96 m³
June	1 080 m²	0,020 m	0,086 m	93 m³
July	1 080 m²	0,020 m	0,086 m	93 m³
August	1 080 m²	0,020 m	0,089 m	96 m³
September	1 080 m²	0,030 m	0,129 m	139 m³
October	1 080 m²	0,040 m	0,177 m	191 m³
November	1 080 m²	0,040 m	0,171 m	185 m³
December	1 080 m²	0,040 m	0,177 m	191 m³
YEAR	1 080 m² (Average)	0,032 m (Average)	1,646 m (Total)	1 777 m³ (Total)

DOMESTIC DEMAND

	Number of individuals	Water / capita / day (Litres)	Total Water / month (Liters)	DOMESTIC DEMAND (m³)
January	25	15 l	11 625 l	12 m³
February	25	15 l	10 500 l	11 m³
March	25	15 l	11 625 l	12 m³
April	25	15 l	11 250 l	11 m³
May	25	15 l	11 625 l	12 m³
June	25	15 l	11 250 l	11 m³
July	25	15 l	11 250 l	11 m³
August	25	15 l	11 625 l	12 m³
September	25	15 l	11 250 l	11 m³
October	25	15 l	11 625 l	12 m³
November	25	15 l	11 250 l	11 m³
December	25	15 l	11 625 l	12 m³
YEAR	25 (Average)	15 l (Average)	11 375 l (Total)	137 m³ (Total)

4. Water Budget Exercise + Safety Factor + Number of Tanks needed

	YIELD from onsite runoff (m³)	DEMAND total onsite water demand (m³)	Monthly Balance	Water in Tank/Reservoir (m³)
January	457 m³	203 m³	254 m³	553 m³
February	252 m³	183 m³	69 m³	621 m³
March	275 m³	203 m³	72 m³	694 m³
April	171 m³	150 m³	21 m³	715 m³
May	44 m³	107 m³	- 64 m³	651 m³
June	24 m³	104 m³	- 80 m³	571 m³
July	10 m³	104 m³	- 94 m³	477 m³
August	20 m³	107 m³	- 87 m³	390 m³
September	74 m³	150 m³	- 76 m³	314 m³
October	238 m³	203 m³	35 m³	0 m³
November	329 m³	196 m³	133 m³	133 m³
December	369 m³	203 m³	166 m³	299 m³
YEAR	4 177 m³ (Total)	1 914 m³ (TOTAL)		

Greatest volume of water in tank/reservoir at any time is the minimum capacity of the tank			715 m³
Safety Factor:	1,5	Final Tank/Reservoir Size:	1 073 m³
Proprietory Tank Volume: (e.g. Jojo Tanks)	744 000 l 744 m³	Number of Tanks needed	2

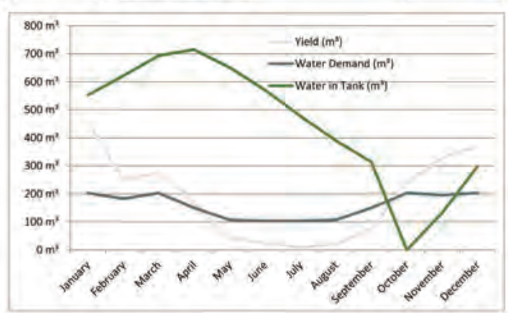


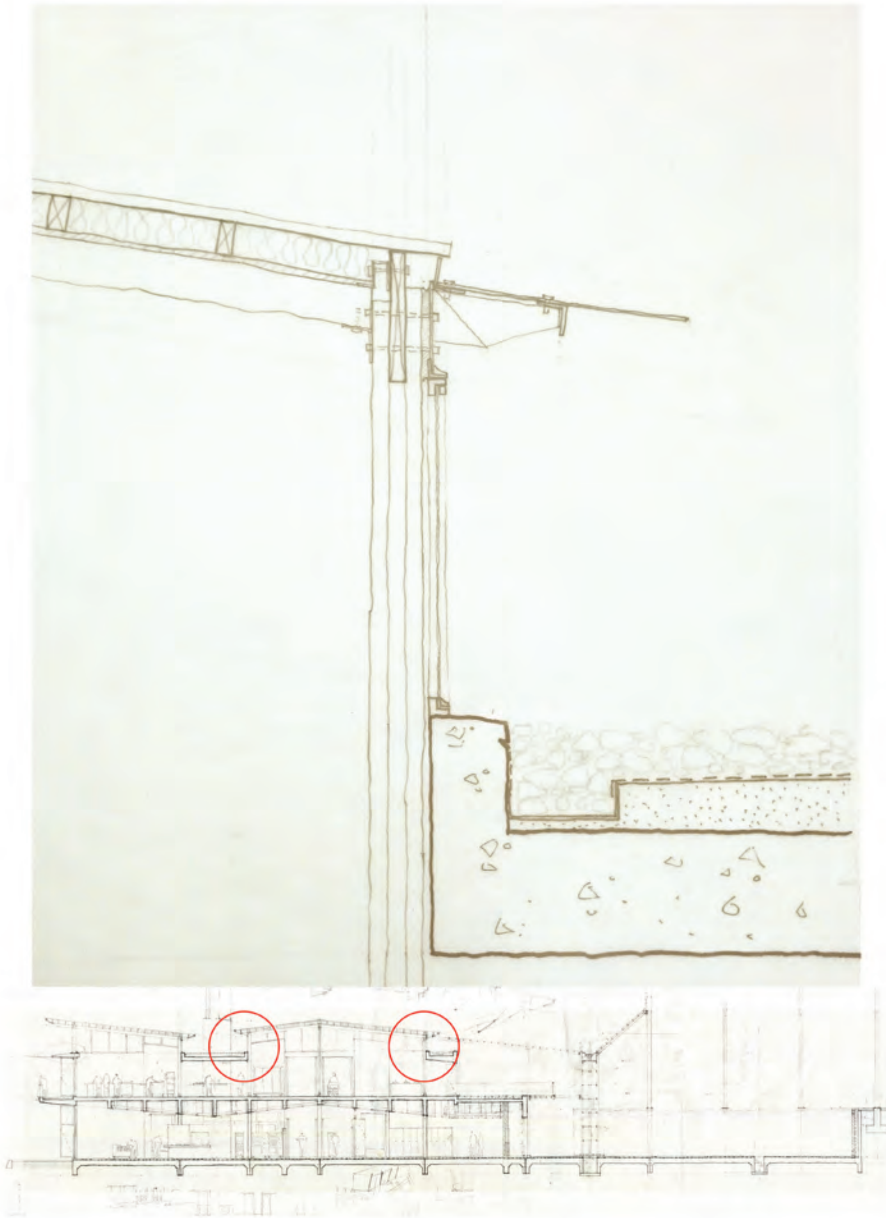
Figure 7.29. Water budget calculation tables (Author 2014).

7.7 Details

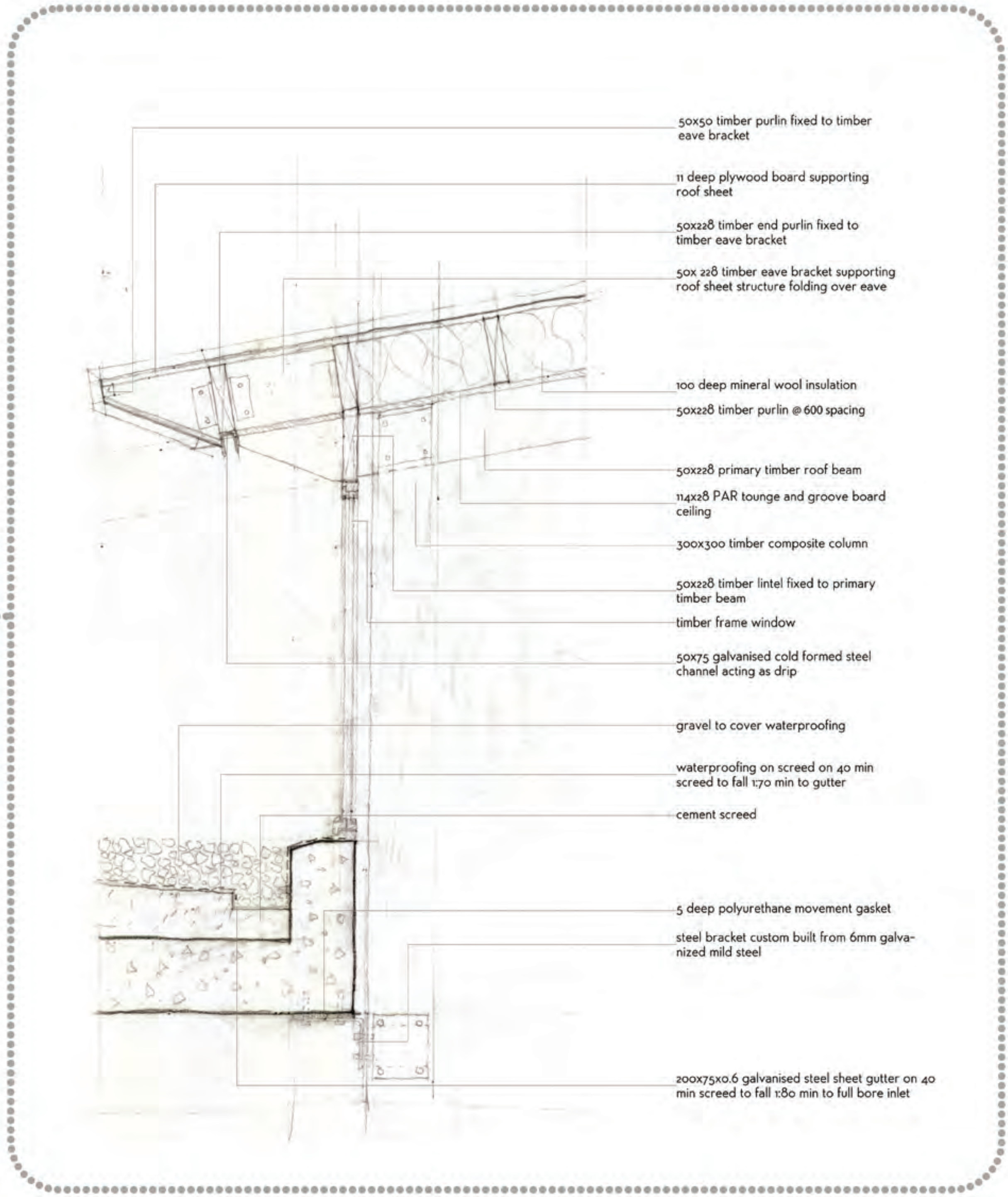
Development of select details are shown in Figures 7.30 to 7.32. More details are still being developed towards the final examination.

Figures 7.30 and 7.31 show eave details of the timber roof structure. The aim of the first iteration in these images was to have the edge of the roof read as thin as possible. The thickness of the edge get progressively thinner to the outside. This is done with the use of steel plates. This detail was complicated however, and difficult to achieve in the second iteration of the roof structure. In the

Figure 7.30. Eave detail one (Author 2014).



current iteration a standing seam roof sheet is wrapped around the edge of the overhang to create the impression of a roof constructed from a single material. Hiding the structure of the roof also aids in the conceptual approach of having the seemingly rational for decay into the landscape. At this part of the building this decay has already progressed, and hiding the structure creates the impression that the roof is held up only with columns and very few beams, floating over the landscape in a romantic gesture.



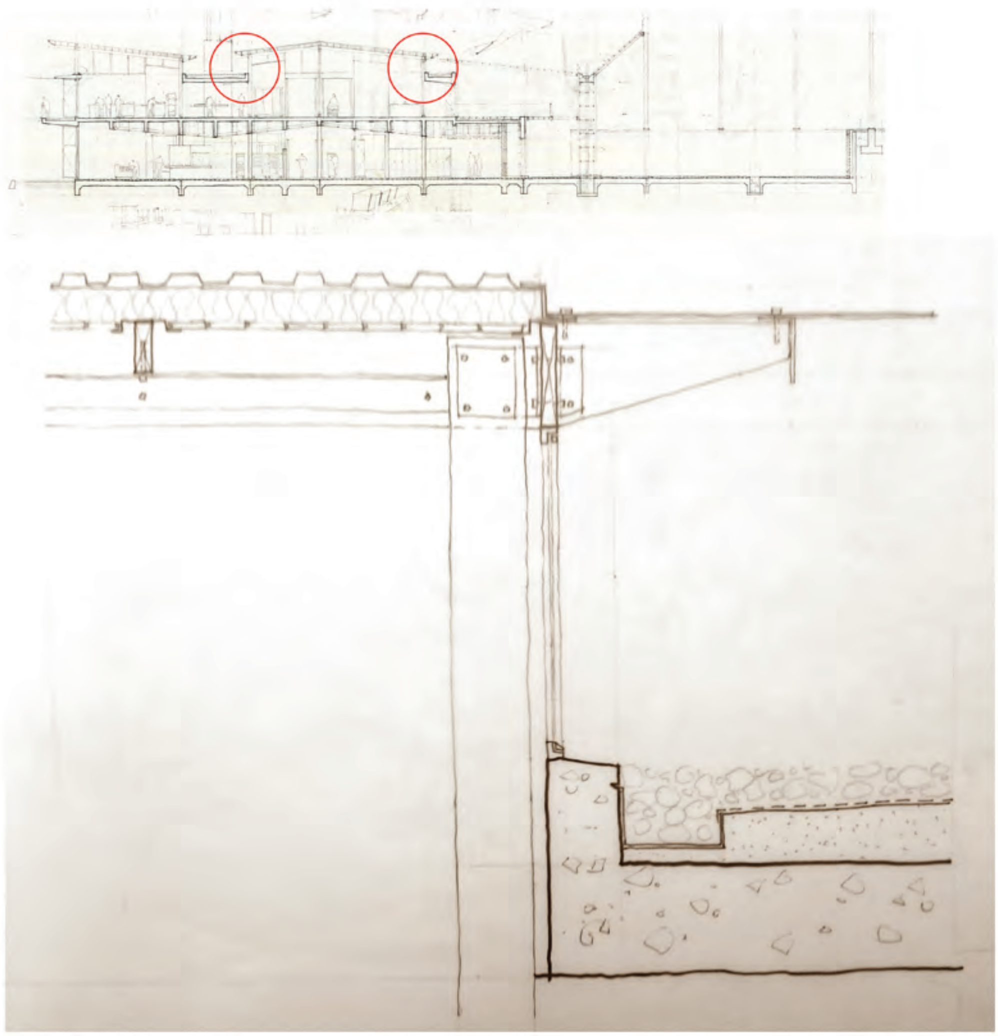


Figure 7.31. Eave detail two (Author 2014).

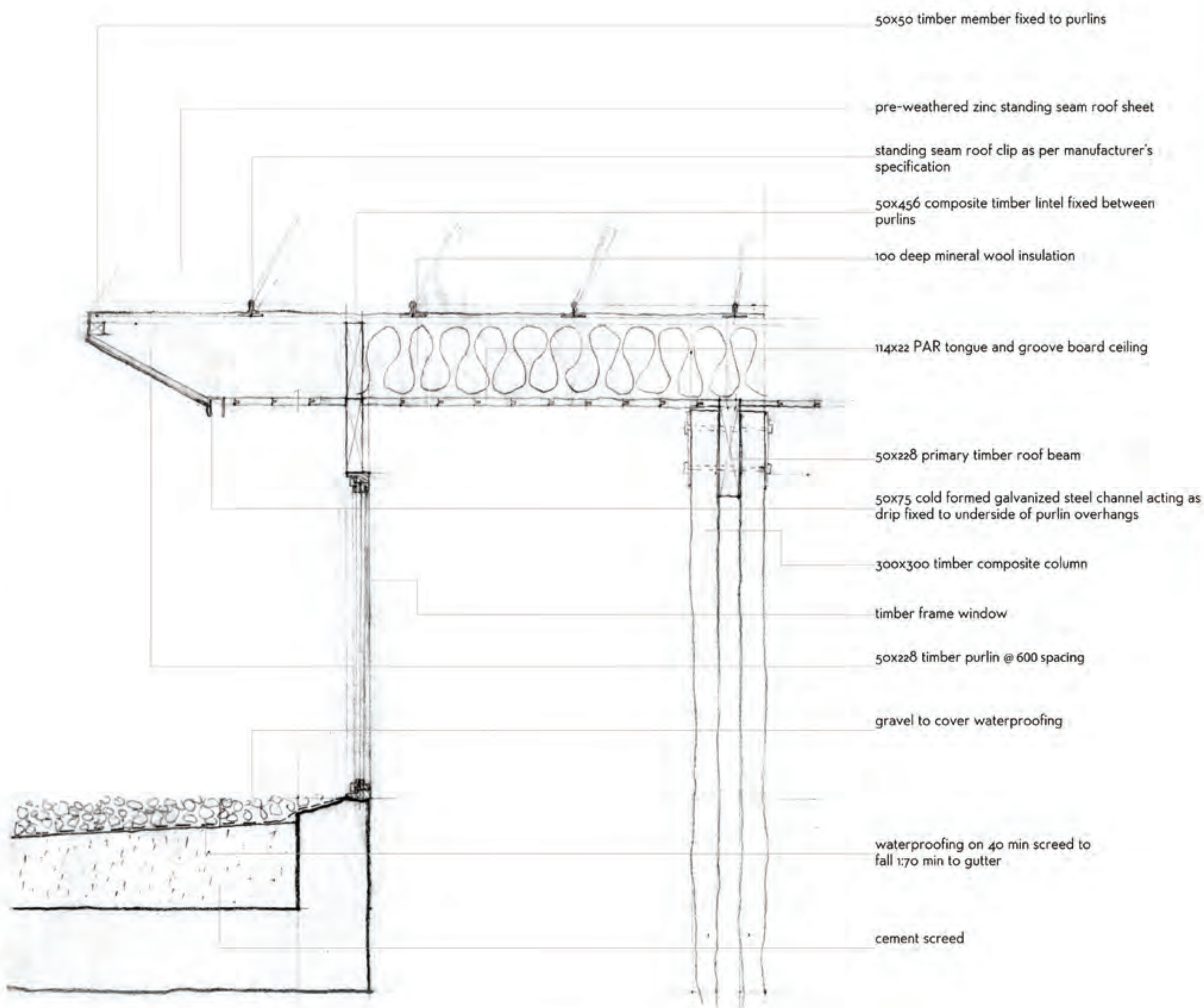

50x50 timber member fixed to purlins
pre-weathered zinc standing seam roof sheet
standing seam roof clip as per manufacturer's specification
50x456 composite timber lintel fixed between purlins
100 deep mineral wool insulation
114x22 PAR tongue and groove board ceiling
50x228 primary timber roof beam
50x75 cold formed galvanized steel channel acting as drip fixed to underside of purlin overhangs
300x300 timber composite column
timber frame window
50x228 timber purlin @ 600 spacing
gravel to cover waterproofing
waterproofing on 40 min screed to fall 1:70 min to gutter
cement screed

Figure 7.32 shows a detail of an opening through the retaining wall on the Eastern side of the building. This is a cavity wall and is part of a cavity basement system. This detail still tries to make the wall seem like a solid massive wall. The reveal is deep and a steel plate wraps around the inside of the opening, exposing only brickwork, creating the monolithic brick effect. The lintels are also hidden for the same reason as the hidden structure in the previous detail. The opening seems to be spanned with only a 6mm steel plate.

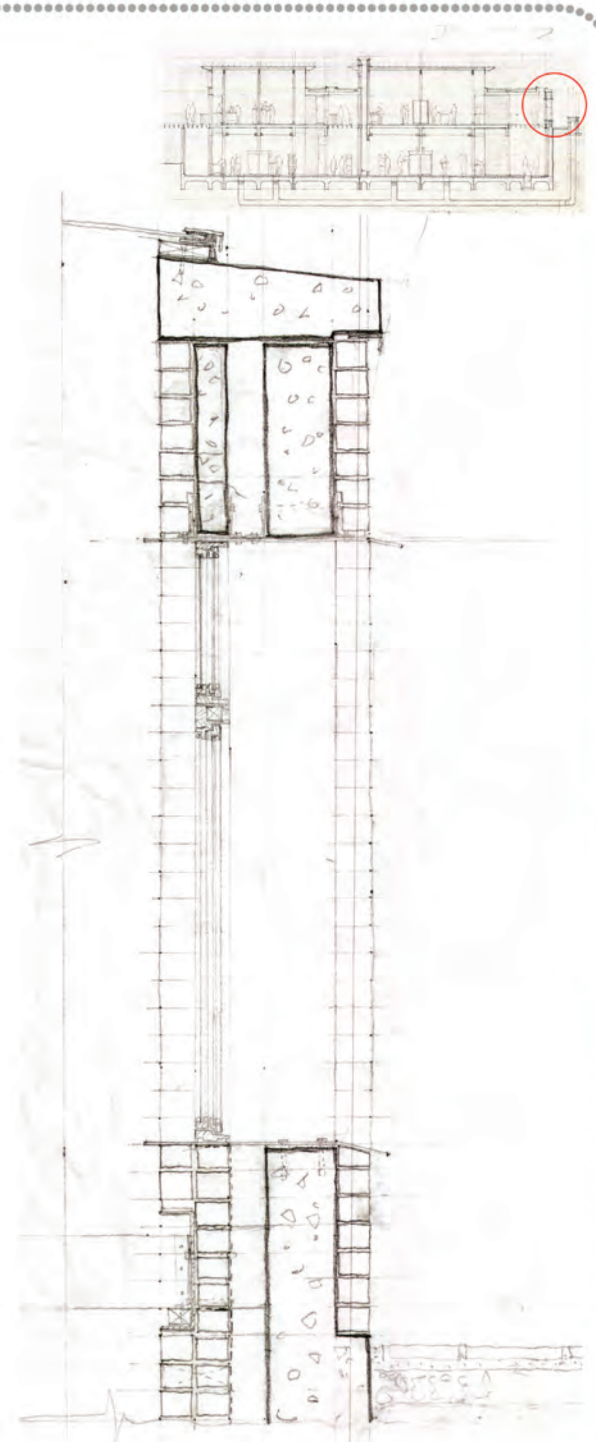
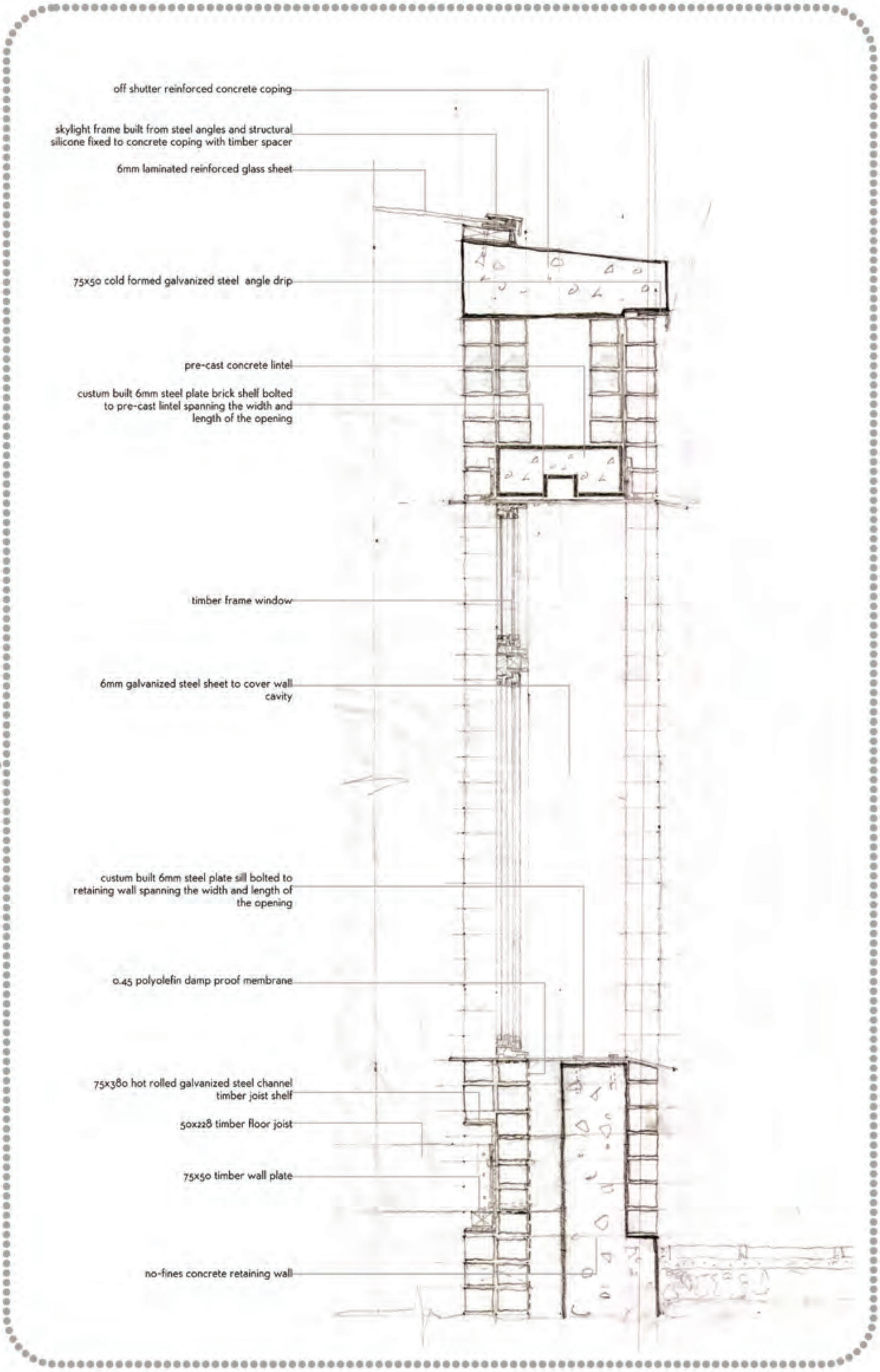


Figure 7.32. Opening detail (Author 2014).


off shutter reinforced concrete coping
skylight frame built from steel angles and structural silicone fixed to concrete coping with timber spacer
6mm laminated reinforced glass sheet
75x50 cold formed galvanized steel angle drip
pre-cast concrete lintel
custum built 6mm steel plate brick shelf bolted to pre-cast lintel spanning the width and length of the opening
timber frame window
6mm galvanized steel sheet to cover wall cavity
custum built 6mm steel plate sill bolted to retaining wall spanning the width and length of the opening
0.45 polyolefin damp proof membrane
75x380 hot rolled galvanized steel channel timber joist shelf
50x228 timber floor joist
75x50 timber wall plate
no-fines concrete retaining wall

7.8 Sustainable Building Assessment Tool analysis

A SBAT analysis was done on the current design and the results are shown in Figures 7.33 to 7.36. Most of the figures that were used in the tool are only estimates. This is because most of the design was done by hand and exact numbers were not available yet, and also because the design has not yet progressed far enough for a few of the criteria.

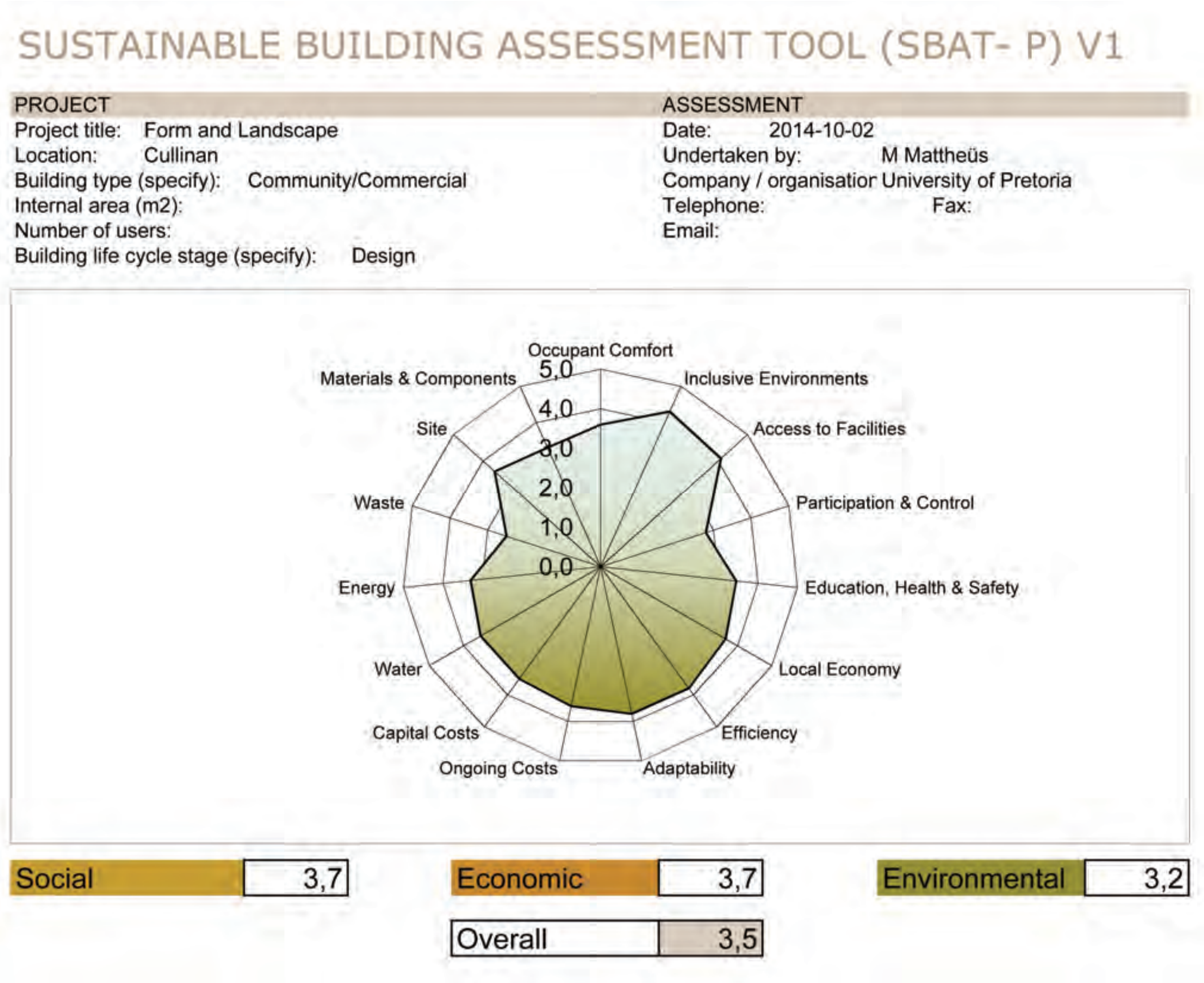


Figure 7.33. SBAT analysis outcome (Author 2014).

Building Performance - Social

	Criteria	Indicative performance measure	Measured	Points
SO 1	**Occupant Comfort**	Explanatory notes		3,6
SO 1.1	Daylighting	% of occupied spaces that are within distance 2H from window, where H is the height of the window or where there is good daylight from skylights	70	0,7
SO 1.2	Ventilation	% of occupied spaces have equivalent of opening window area equivalent to 10% of floor area or adequate mechanical system, with upolluted air source	90	0,9
SO 1.3	Noise	% of occupied spaces where external/internal/reverberation noise does not impinge on normal conversation (50dbA)	70	0,7
SO 1.5	Thermal comfort	Tempreture of occupied space does not exceed 28 or go below 19ºC for less than 5 days per year (100%)	60	0,6
SO 1.5	Views	% of occupied space that is 6m from an external window (not a skylight) with a view	70	0,7
SO 2	**Inclusive Environments**	Explanatory notes		4,3
SO 2.1	Public Transport	% of building (s) within 400m of disabled accessible (20%) and affordable (80%) public transport	90	0,9
SO 2.2	Information	Comprehensive signage provided (50%), Signage high contrast, clear print signage in appropriate locations and language(s) / use of understandable symbols / manned reception at all entrances (50%)	80	0,8
SO 2.3	Space	% of occupied spaces that are accessible to ambulant disabled / wheelchair users	90	0,9
SO 2.4	Toilets	% of occupied space with fully accessible toilets within 50m along easily accessible route	80	0,8
SO 2.5	Fittings & Furniture	% of commonly used furniture and fittings (reception desk, kitchenette, auditorium) fully accessible	90	0,9
SO 3	**Access to Facilities**	Explanatory notes		4,1
SO 3.1	Children	All users can walk (100%) / use public transport (50%) to get to their childrens' schools and creches	80	0,8
SO 3.2	Banking	All users can walk (100%) / use public transport (50%) to get to banking facilities	80	0,8
SO 3.3	Retail	All users can walk (100%) / use public transport (50%) to get to food retail	90	0,9
SO 3.4	Communication	All users can walk (100%) / use public transport (50%) to get to communication facilities (post/telephone/internet)	80	0,8
SO 3.5	Exercise	All users can walk (100%) / use public transport (50%) to get to recreation/excercise facilities	80	0,8
SO 4	**Participation & Control**	Explanatory notes		2,8
SO 4.1	Environmental control	% of occupied space able to control their thermal environment (adjacent to openable windows/thermal controls)	50	0,5
SO 4.2	Lighting control	% of occupied space able to control their light (adjacent to controllable blinds etc/local lighting control)	50	0,5
SO 4.3	Social spaces	Social informal meeting spaces (parks / staff canteens / cafes) provided locally (within 400m) (100%)	90	0,9
SO 4.4	Sharing facilties	5% or more of facilities shared with other users / organisations on a weekly basis (100%)	70	0,7
SO 4.5	User group	Users actively involved in the design process (50%) / Active and representative management user group (50%)	20	0,2
SO 5	**Education, Health & Safety**	Explanatory notes		3,5
SO 5.1	Education	Two percent or more space/facilities available for education (seminar rooms / reading / libraries) per occupied space (75%). Construction training provided on site (25%)	70	0,7
SO 5.2	Safety	All well used routes in and around building well lit (25%), all routes in and around buildings visually supervised (25%), secure perimeter and access control (50%), No crime (100%)	95	1,0
SO 5.3	Awareness	% of users who can access information on health & safety issues (ie HIV/AIDS), training and employment opportunities easily (posters/personnel/intranet site)	80	0,8
SO 5.4	Materials	All materials/components used have no negative effects on indoor air quality (100%)	80	0,8
SO 5.5	Accidents	Process in place for recording all occupational accidents and diseases and addressing these	20	0,2

Figure 7.34. SBAT analysis social (Author 2014).

Building Performance - Economic

	Criteria	Indicative performance measure	Measured	Points
EC 1	**Local economy**	Explanatory notes		3,7
EC 1.1	Local contractors	% value of the building constructed by local (within 50km) small (employees<20) contractors	65	0,7
EC 1.2	Local materials	% of materials (sand, bricks, blocks, roofing material) sourced from within 50km	70	0,7
EC 1.3	Local components	% of components (windows, doors etc) made locally (in the country)	80	0,8
EC 1.4	Local furniture/fittings	% of furniture and fittings made locally (in the country)	80	0,8
EC 1.5	Maintenance	% of maintenance and repairs by value that can, and are undertaken, by local contractors (within 50km)	70	0,7
EC 2	**Efficiency**	Explanatory notes		3,8
EC 2.1	Capacity	% capacity of building used on a daily basis (actual number of users / number of users at full capacity*100)	80	0,8
EC 2.2	Occupancy	% of time building is occupied and used (actual average number of hours used / all potential hours building could be used (24) *100)	80	0,8
EC 2.3	Space per occupant	Space provision per user not more than 10% above national average for building type (100%)	60	0,6
EC 2.4	Communication	Site/building has access to internet and telephone (100%), telephone only (50%)	90	0,9
EC 2.5	Material & Components	Building design coordinated with material / component sizes in order to minimise wastage. Walls (50%), Roof and floors (50%)	70	0,7
EC 3	**Adaptability**	Explanatory notes		3,1
EC 3.1	Vertical heights	% of spaces that have a floor to ceiling height of 3000mm or more	80	0,8
EC 3.2	External space	Design facilitates flexible external space use (100%)	90	0,9
EC 3.3	Internal partition	Non loadbearing internal partitions that can be easily adapted (loose partioning (100%), studwall (50%), masonary (25%)	20	0,2
EC 3.4	Modular planning	Building with modular stucture, envelope (fenestration) & services allowing easily internal adaptaptation (100%)	50	0,5
EC 3.5	Furniture	Modular, limited variety furniture - can be easily configured for different uses (100%)	70	0,7
EC 4	**Ongoing costs**	Explanatory notes		3,6
EC 4.1	Induction	All new users receive induction training on building systems (50%), Detailed building user manual (50%	50	0,5
EC4.2	Consumption & waste	% of users exposed on a monthly basis to building performance figures (water (25%), electricity (25%), waste (25%), accidents (25%)	80	0,8
EC 4.2	Metering	Easily monitored localised metering system for water (50%) and energy (50%)	70	0,7
EC4.3	Maintenance & Cleaning	% of building that can be cleaned and maintained easily and safely using simple equipment and local non-hazardous materials	80	0,8
SO 4.5	Procurement	% of value of all materials/equipment used in the building on a daily basis supplied by local (within the country) manufacturers	80	0,8
EC 5	**Capital Costs**	Explanatory notes		3,5
EC 5.1	Local need	Five percent capital cost allocated to address urgent local issues (employment, training etc) during construction process (100%)	80	0,8
EC5.2	Procurement	Tender / construction packaged to ensure involvement of small local contractors/manufacturers (100%)	80	0,8
EC 5.3	Building costs	Capital cost not more than fifteen % above national average building costs for the building type (100%)	30	0,3
EC5.4	Technology	3% or more of capital costs allocated to new sustainable/indigenous technology (100%)	80	0,8
EC 5.5	Existing Buildings	Existing buildings reused (100%)	80	0,8

Figure 7.35. SBAT analysis economic (Author 2014).

Building Performance - Environmental

	Criteria	Indicative performance measure	Measured	Points
EN 1	**Water**	Explanatory notes		3,5
EN 1.1	Rainwater	% of water consumed sourced from rainwater harvested on site	70	0,7
EN 1.2	Water use	% of equipment (taps, washing machines, urinals showerheads) that are water efficient	70	0,7
EN 1.3	Runoff	% of carparking, paths, roads and roofs that have absorbant/semi absorbant/permeable surfaces (grassed/thatched/looselaid paving/ absorbant materials)	60	0,6
EN 1.4	Greywater	% of water from washing/relatively clean processes recycled and reused	90	0,9
EN 1.5	Planting	% of planting (other than food gardens) on site with low / appropriate water requirements	60	0,6
EN 2	**Energy**	Explanatory notes		3,3
EN 2.1	Location	% of users who walk / cycle / use public transport to commute to the building	80	0,8
EN 2.2	Ventilation	% of building ventilation requirements met through natural / passive ventilation	50	0,5
EN 2.3	Heating & Cooling	% of occupied space which relies solely on passive environmental control (no or minimal energy consumption)	50	0,5
EN 2.4	Appliances & fittings	% of appliances / lighting fixtures that are classed as highly energy efficient (ie energy star rating)	90	0,9
EN 2.5	Renewable energy	% of building energy requirements met from renewable sources	60	0,6
EN 3	**Waste**	Explanatory notes		2,5
EN 3.1	Toxic waste	% of toxic waste (batteries, ink cartridges, flourescent lamps) recycled	60	0,6
EN 3.2	Organic waste	% of organic waste recycled	60	0,6
EN 3.3	Inorganic waste	% of inorganic waste recycled.	80	0,8
EN 3.4	Sewerage	% of sewerage recycled on site	0	0,0
EN 3.5	Construction waste	% of damaged building materials / waste developed in construction recycled on site	50	0,5
EN 4	**Site**	Explanatory notes		3,6
EN 4.1	Brownfield site	% of proposed site already disturbed / brownfield (previously developed)	100	1,0
EN 4.2	Neighbouring buildings	No neighbouring buildings negatively affected (access to sunlight, daylight, ventilation) (100%)	90	0,9
EN 4.3	Vegetation	% of area of area covered in vegetation (include green roofs, internal planting) relative to whole site	50	0,5
EN 4.4	Food gardens	Food gardens on site (100%)	70	0,7
EN 4.5	Landscape inputs	% of landscape that does not require mechanical equipment (ie lawn cutting) and or artificial inputs such as weed killers and pesticides	50	0,5
EN 5	**Materials & Componer**	Explanatory notes		3,3
EN 5.1	Embodied energy	Materials with high embodied energy (aluminium,plastics) make up less than 1% of weight of building (100%)	70	0,7
EN 5.2	Material sources	% of materials and components by volume from grown sources (animal/plant)	40	0,4
EN 5.3	Ozone depletion	No materials and components used requiring ozone depleting processes (100%)	80	0,8
EN 5.4	Recyled / reuse	% of materials and components (by weight) reused / from recycled sources	70	0,7
EN 5.5	Construction process	Volume / area of site disturbed during construction less than 2X volume/area of new building (100%)	70	0,7

Figure 736. SBAT analysis environmental (Author 2014).

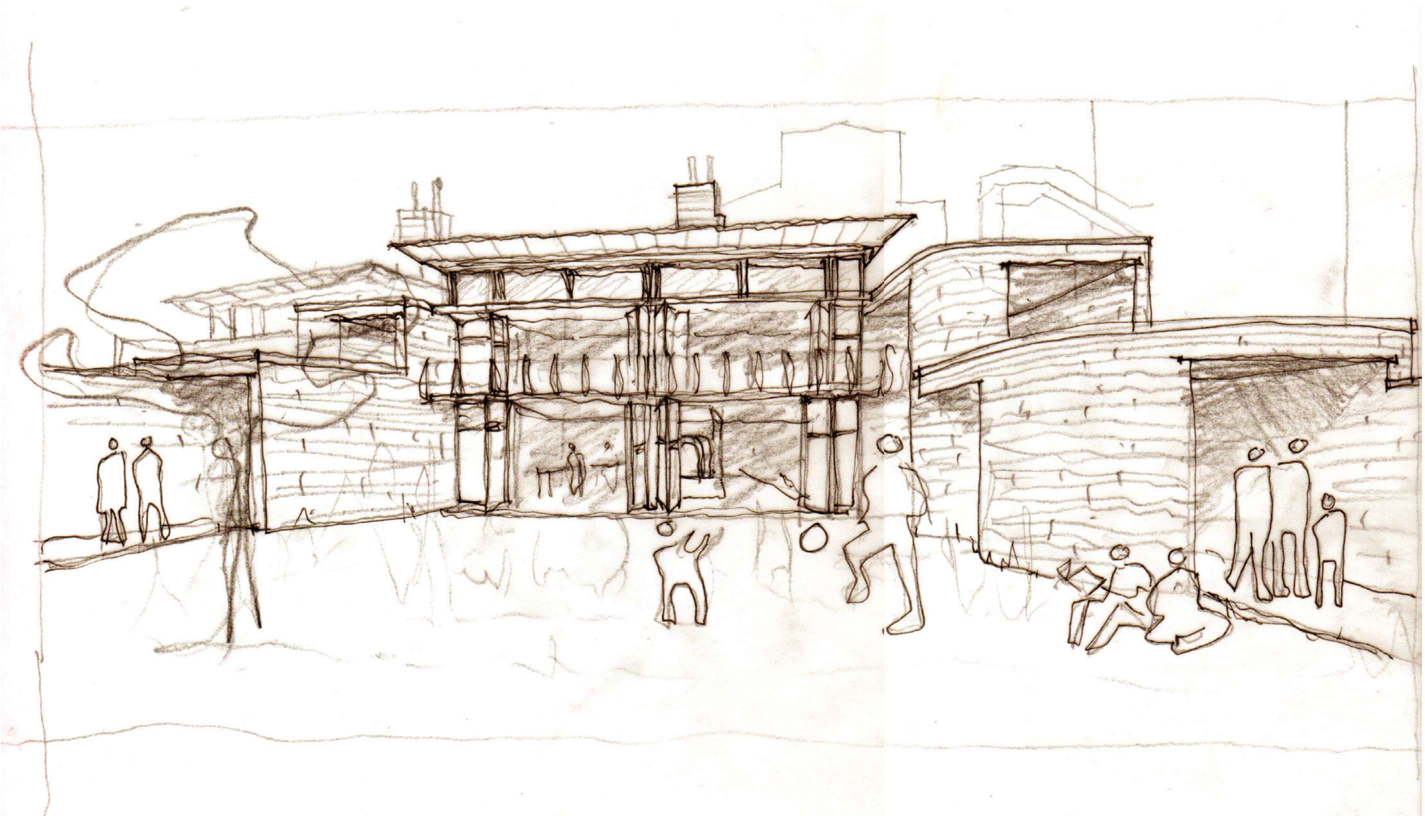


Figure 8.1. View from picnic area in front of baking space (Author 2014).

Chapter 8
Conclusion

'. . . Through the concept of the site and the principle of settlement, the environment becomes . . . the essence of architectural production. From this vantage point, new principles and methods can be seen for design.' Vittorio Gregotti (Frampton 1995: 8).

This dissertation aimed to investigate ways of generating architectural form other than the purely rational and objective means that the author and a large number of other architects have become accustomed to. Objective rational means of form generation are predominant in the context of Cullinan, a town that needs a new approach to sustaining itself after the impending closure of the diamond mine. Apart from this, this dissertation was also a means for the author to expand on his design skills. To develop a richer vocabulary of ways to generate architectural form.

It has been argued that a resource that can be tapped into to ensure the livelihood of Cullinan after the mine's closure, is natural setting and landscape. By reconnecting the townspeople with a resilient network of income generators stemming from this landscape, the town could still sustain itself in the future.

The very nature of this landscape is sublime. It forces an emotional response upon experience. This then, was a starting point for the investigation of theory which argues that this emotional response can link the townspeople and visitors to the romantic landscape, revealing otherwise inaccessible truths about the importance of this connection.

Within this theory a method to design a building, and a program which is appropriate to this method of interaction with the landscape was identified. This design method was used to design a building form which could link the user, and their objective observations to the landscape of Cullinan through use of the sublime's effect on their intuitions.

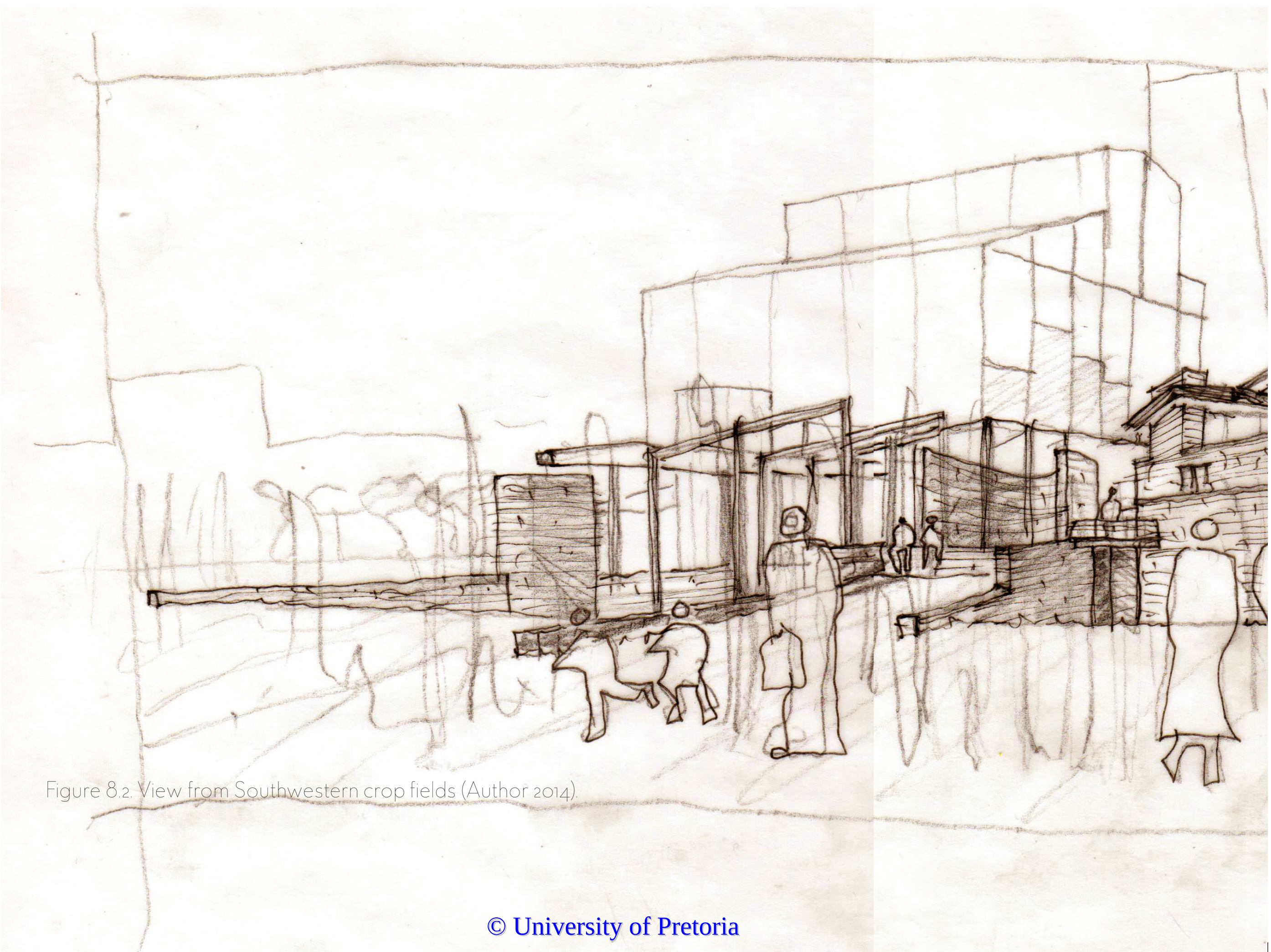


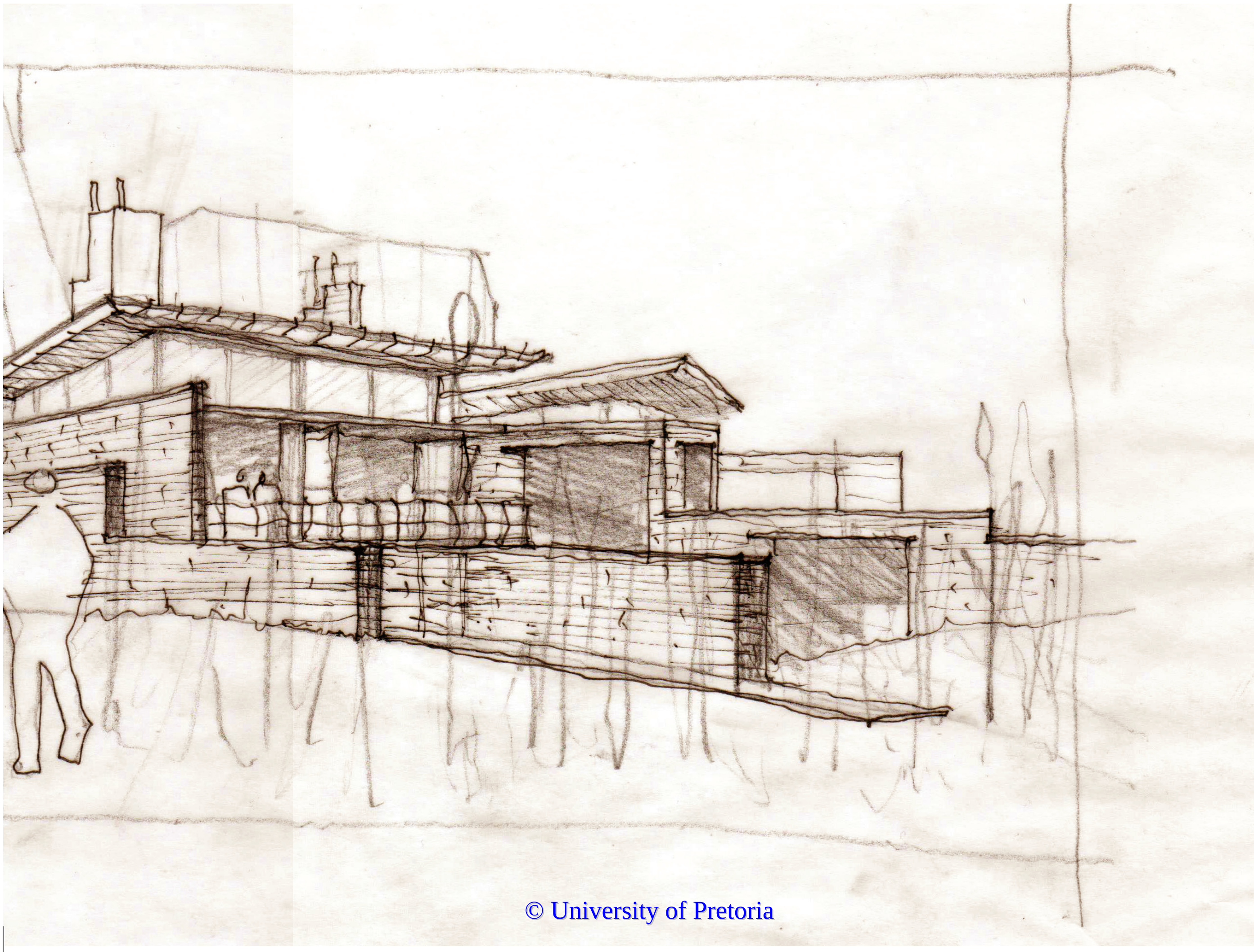
Figure 8.2. View from Southwestern crop fields (Author 2014).

In the technical development, we can see that the form of the building and the way it is experienced is also influenced by the way its parts are articulated. That is to say, the form is influenced by the way the building is constructed, even on a detailed level.

Although the building form that was designed might not be as economically viable as one designed through focus on purely rational influences. But this contrast with the existing forms in the study area, which were designed with purely rational and economic influences, is argued to enrich the resilience of the town, just as a multi-pronged approach to industry will. Despite of this the building has been show to perform reasonably well in terms of sustainable practices.

Furthermore, because this building was not designed with purely rational influences on its form, the building might still be useful when these rational influences (the program and industry) are no longer needed in the town. A study on how a ruin might link humans to nature is included in the dissertation. This building form, even in a ruined state without a program, could still create an emotional link between the townspeople and the natural landscape of Cullinan. This is because the method used to do this does not completely disappear when the building decays into the landscape. Romantic influences on the form would still perform their purpose if the building has fallen into ruin, tapping into the sublime nature of the natural landscape and resonating with it, as state of ruin was also a part of formal exploration.

The merit of the building form then extends beyond how effectively it houses a current program. It also gains merit because it can be seen as a resilient method of linking the user with the landscape of Cullinan.



Representations

The following images show further work that has been done toward the final examination.

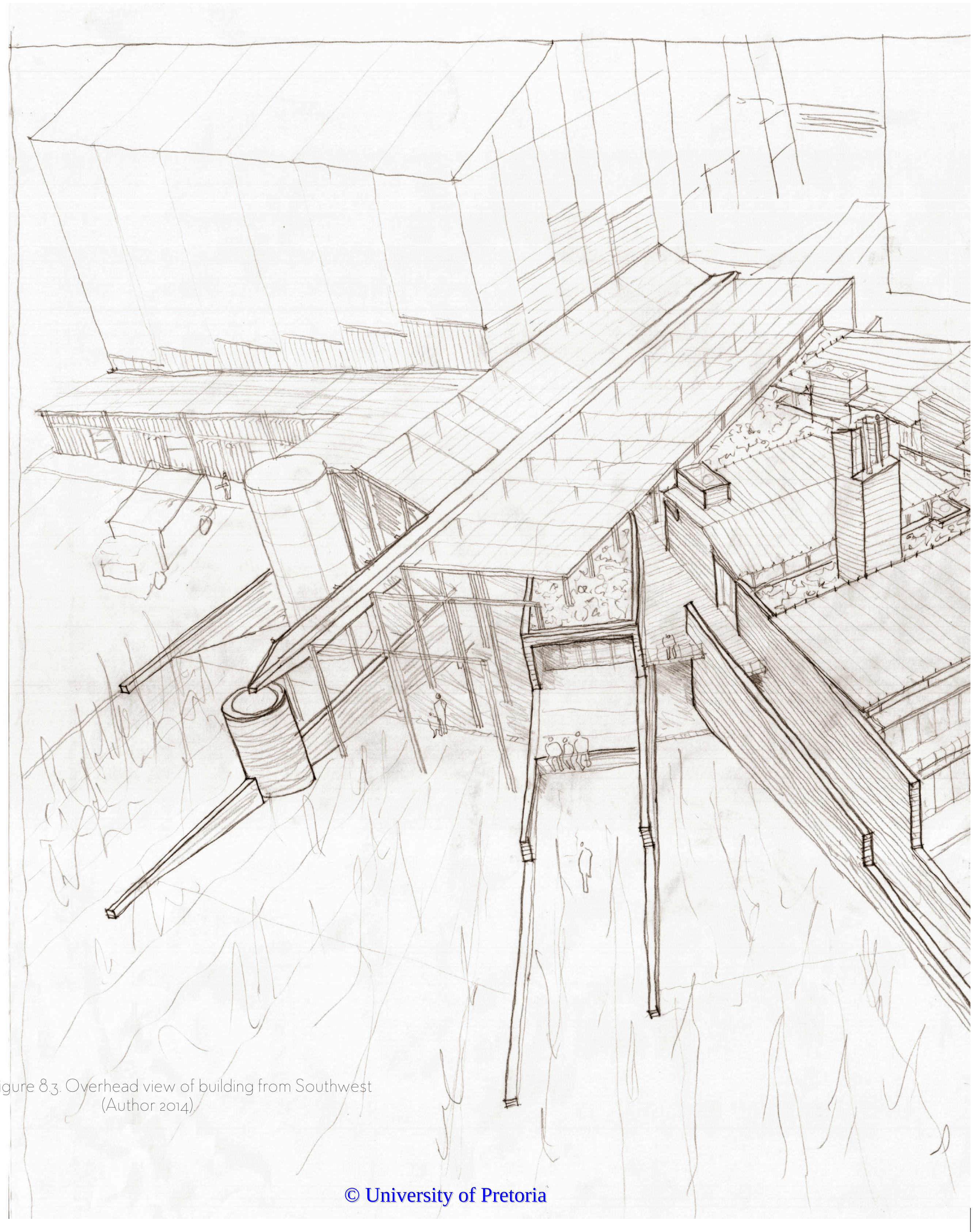
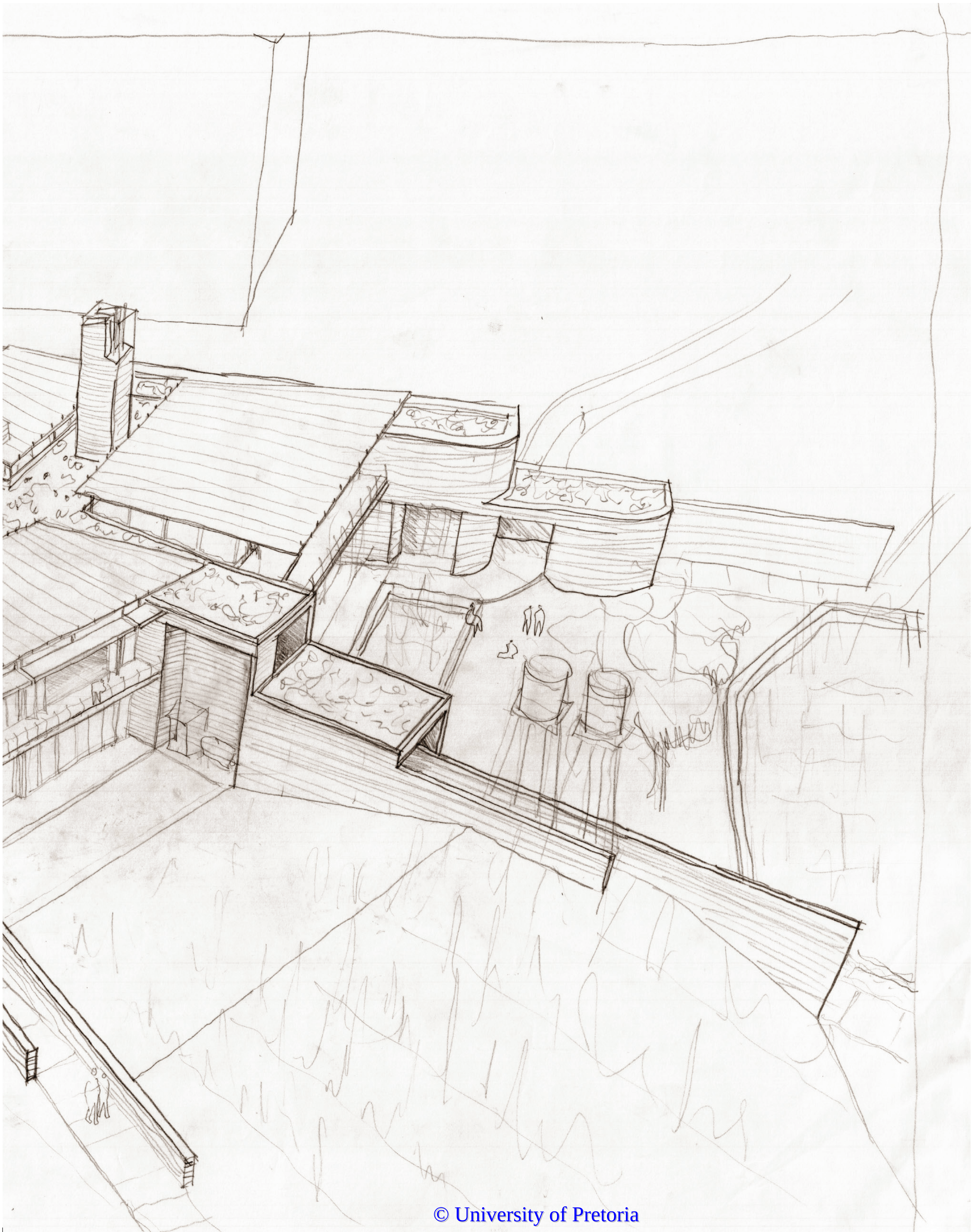


Figure 8.3. Overhead view of building from Southwest (Author 2014)



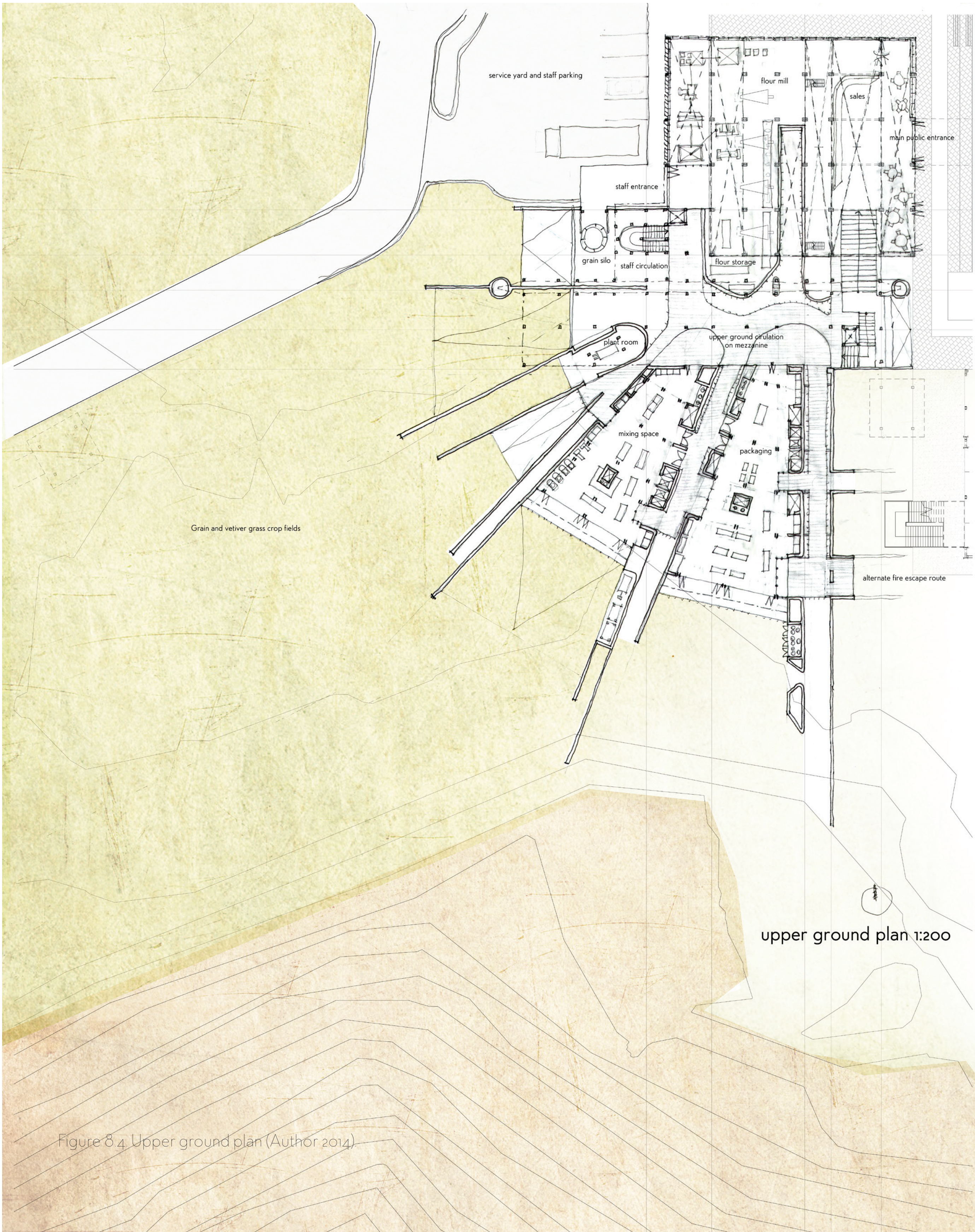


Figure 8.4 Upper ground plan (Author 2014).

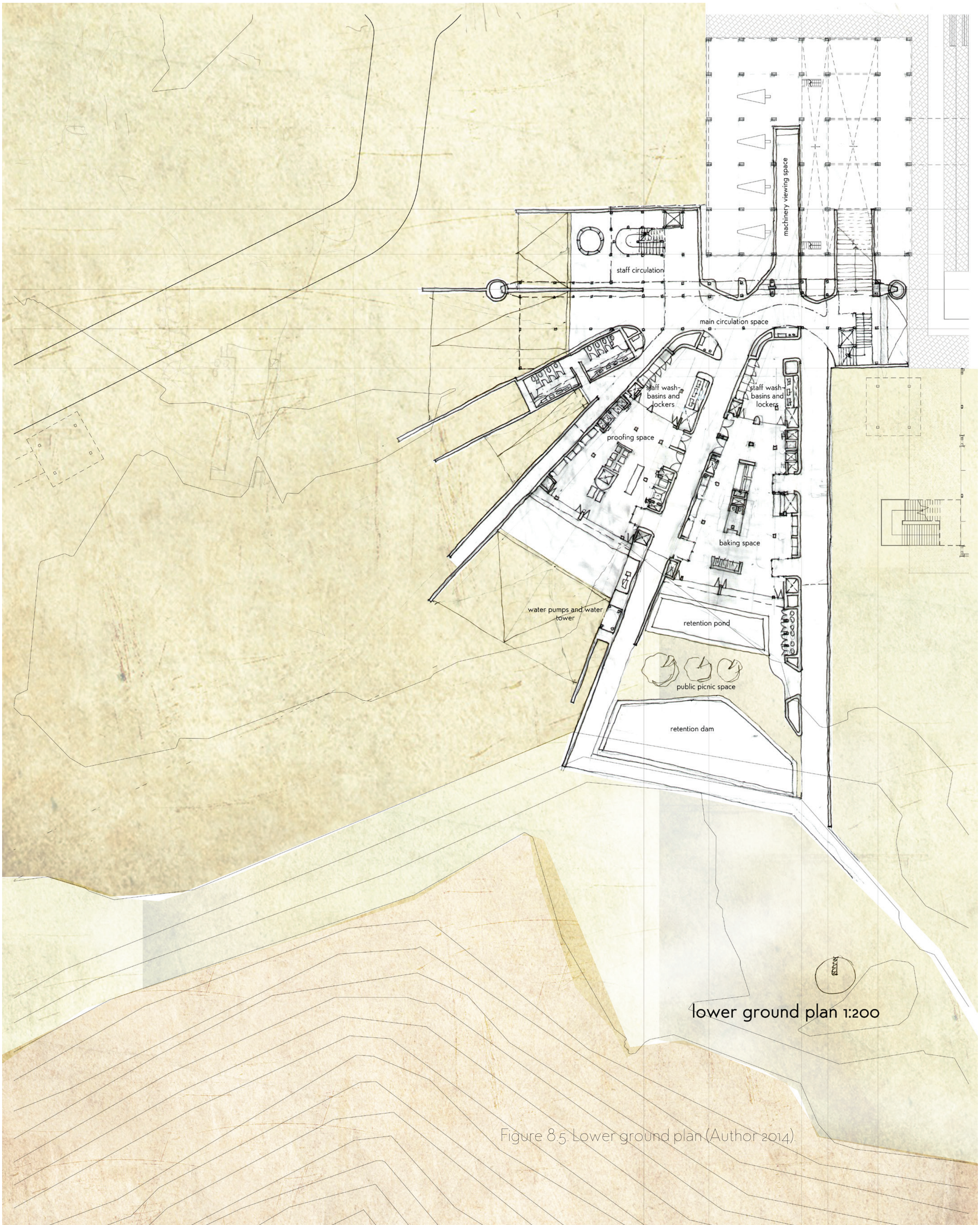
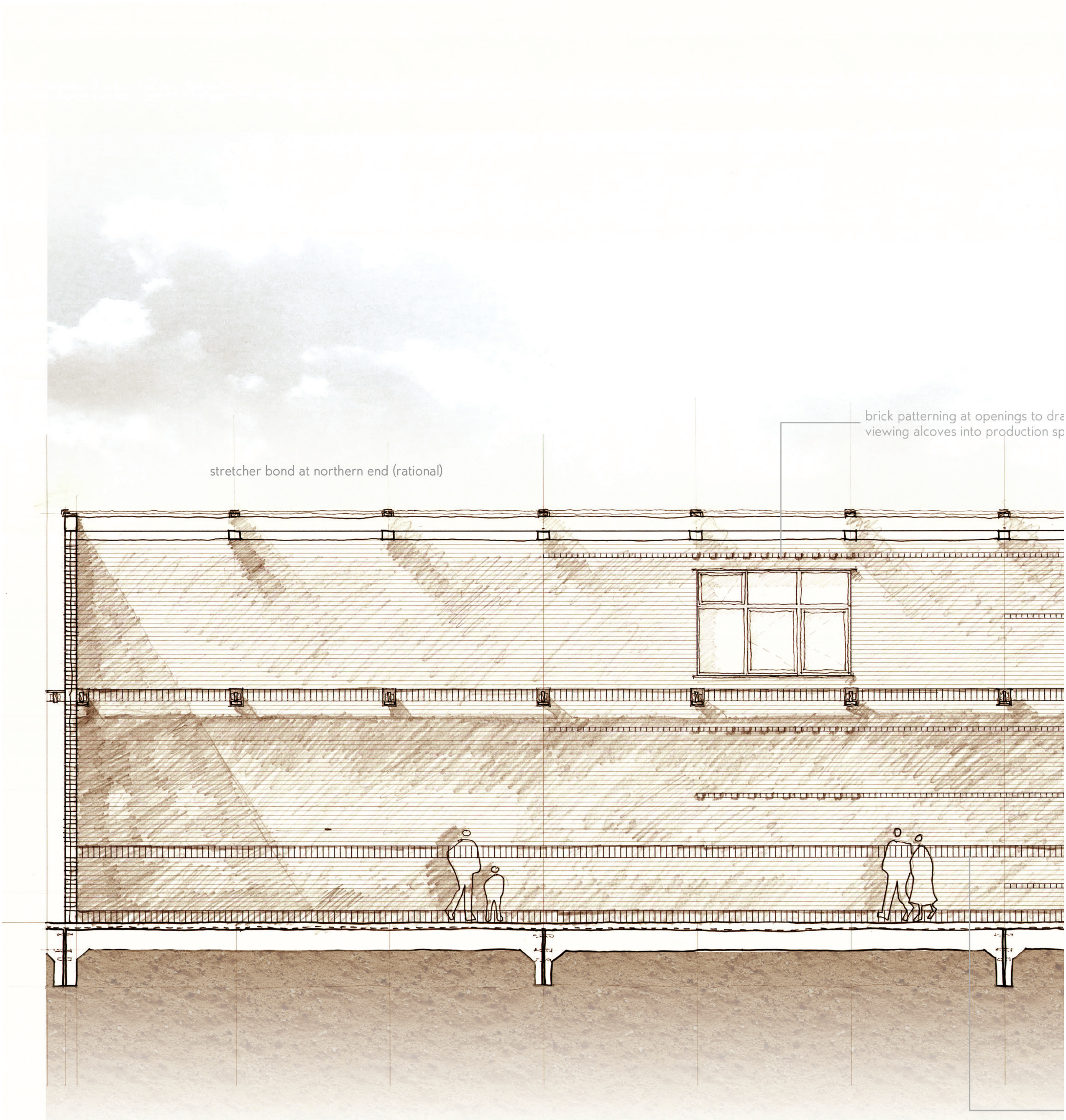


Figure 8.5. Lower ground plan (Author 2014).



section through eastern circulation path 1:50

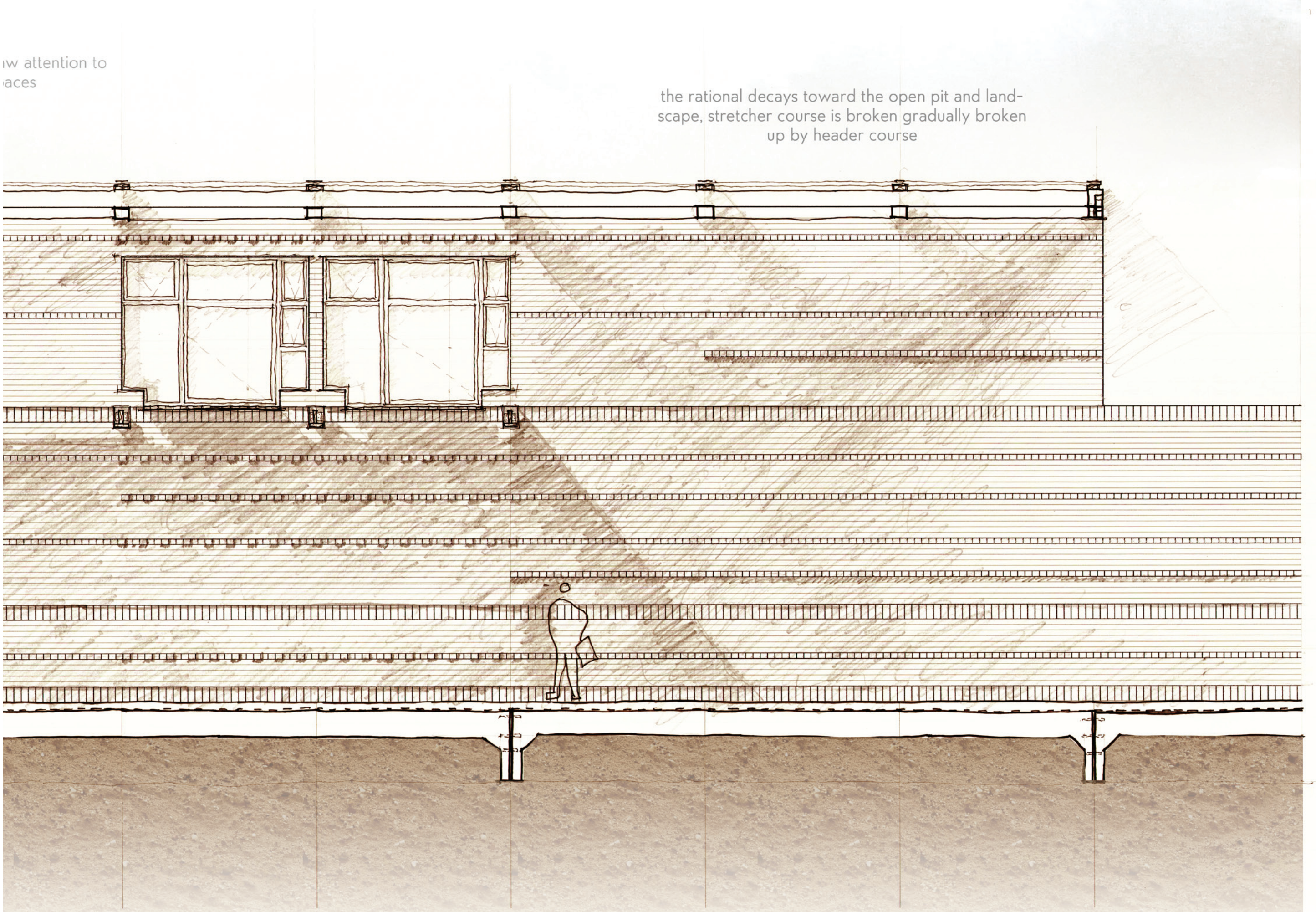


Figure 8.6. Brick coursing on inside of eastern pathway showing dissolving rationality (Author 2014).

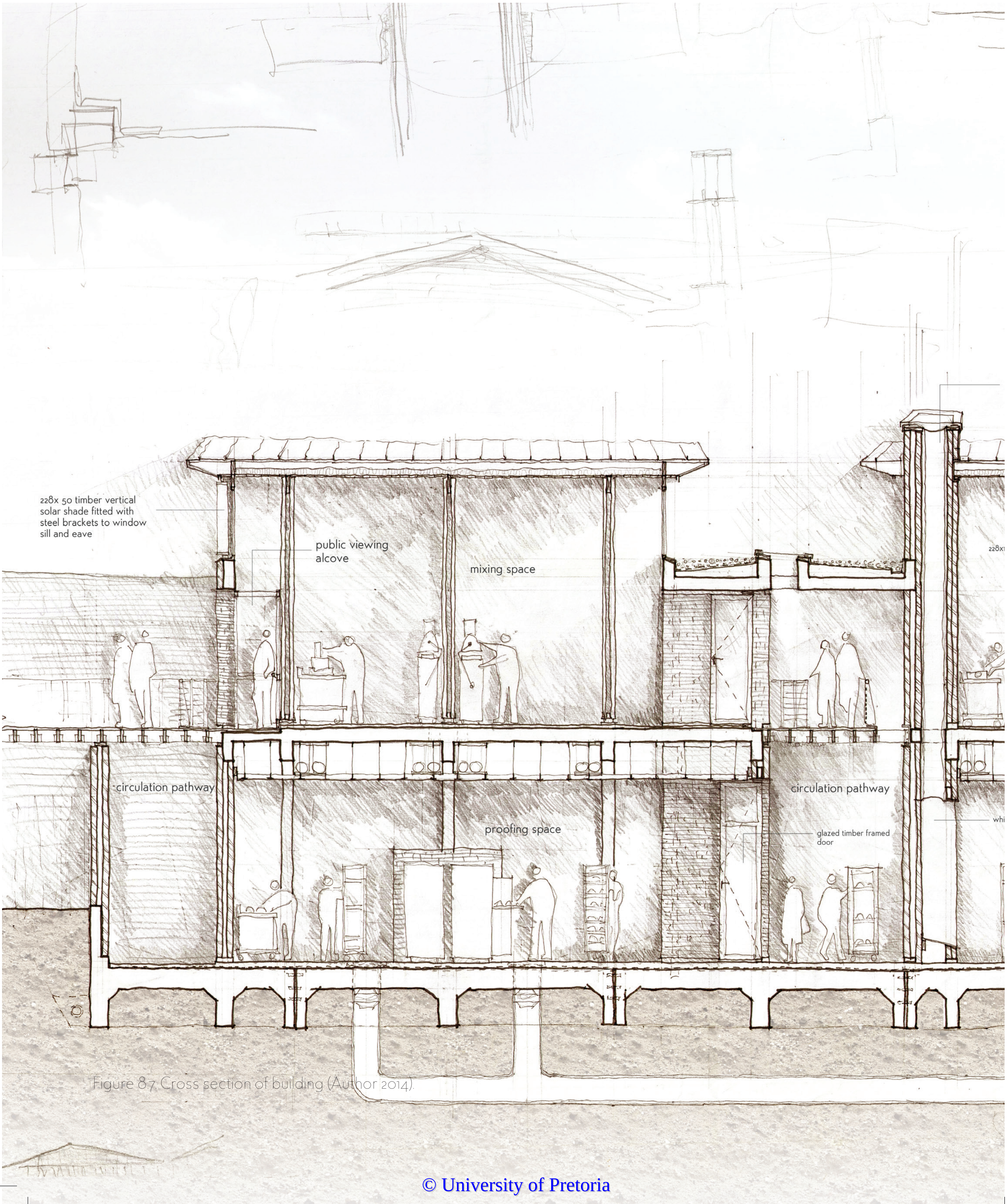
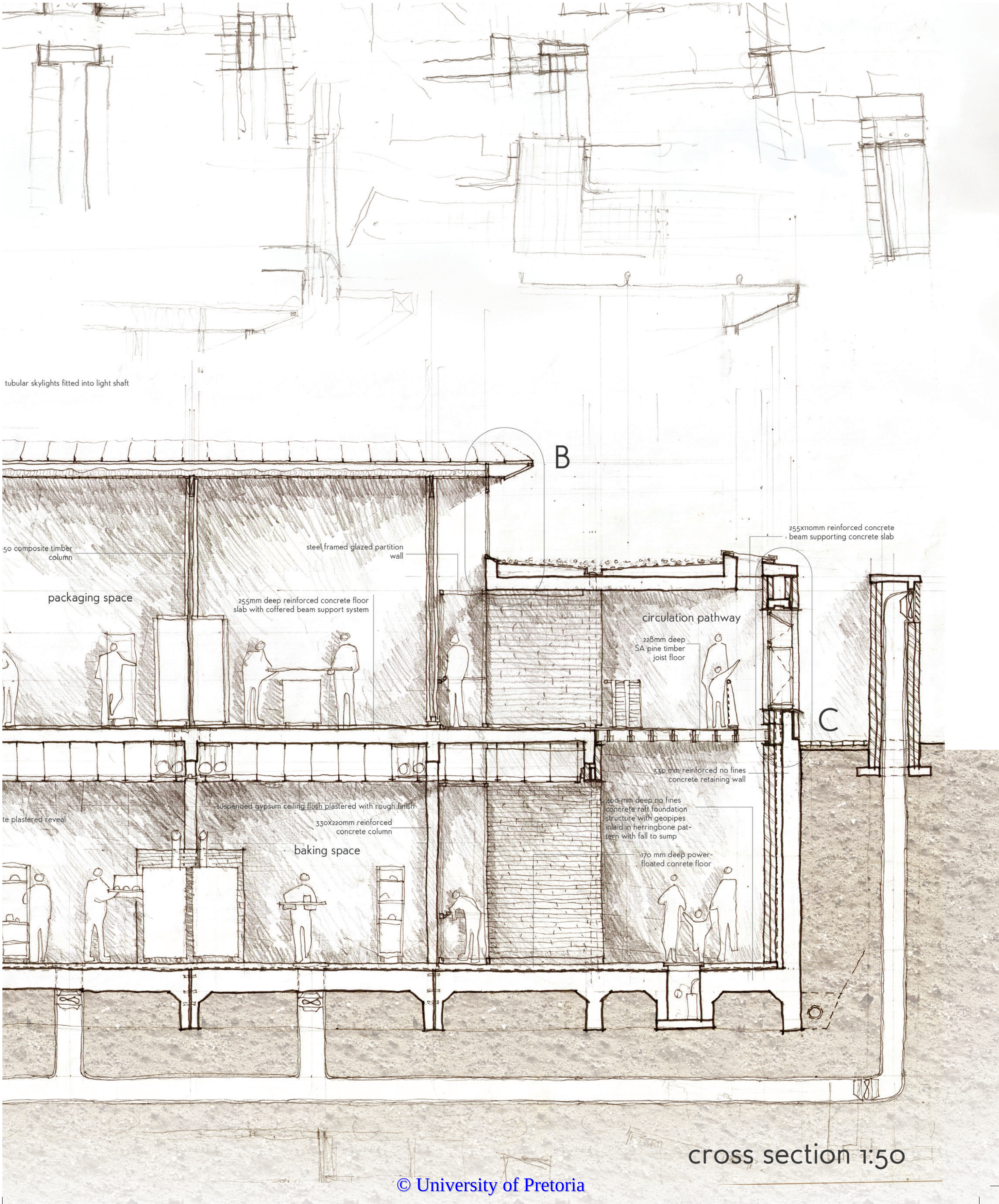
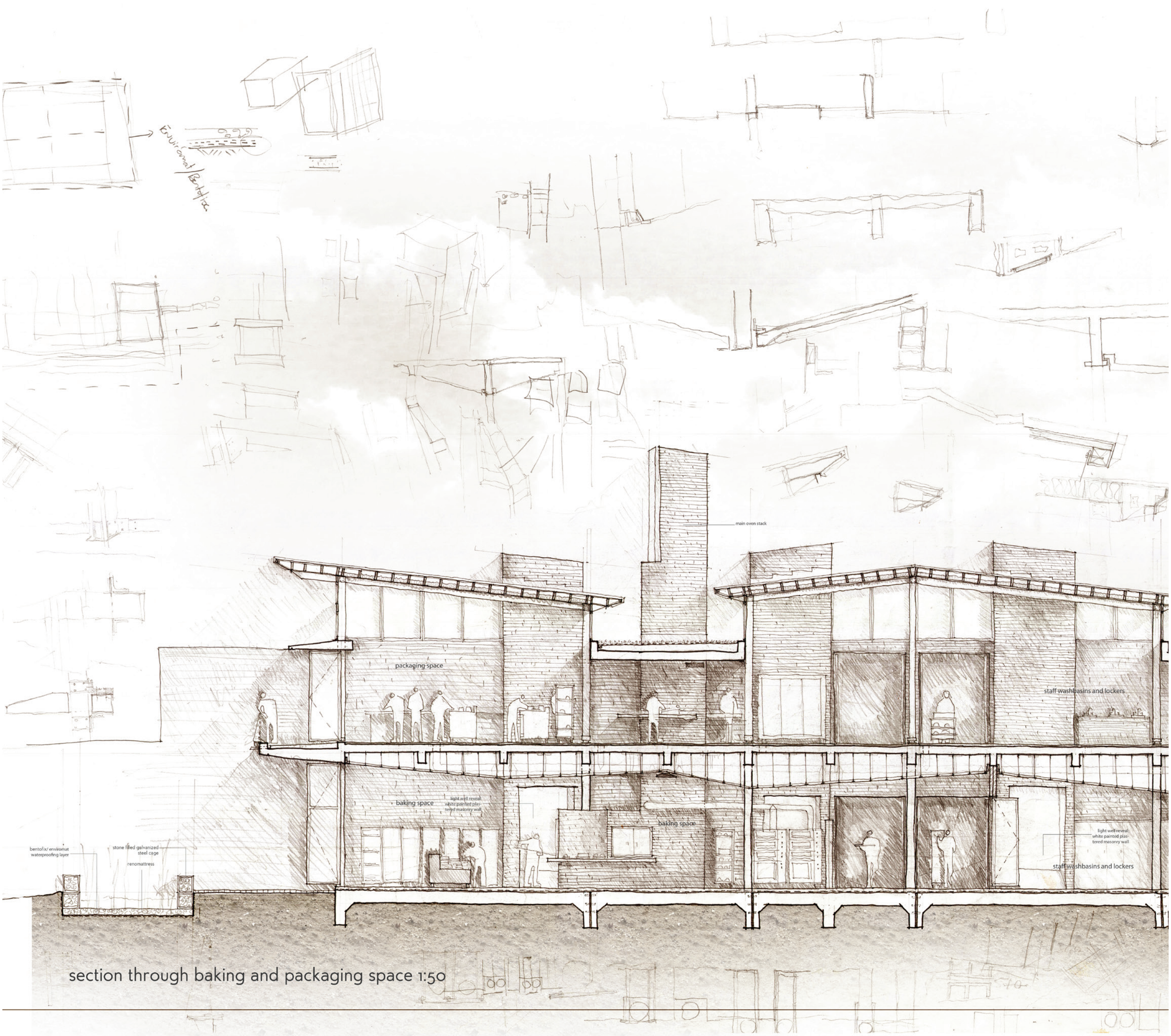


Figure 8.7 Cross section of building (Author 2014).



cross section 1:50



section through baking and packaging space 1:50

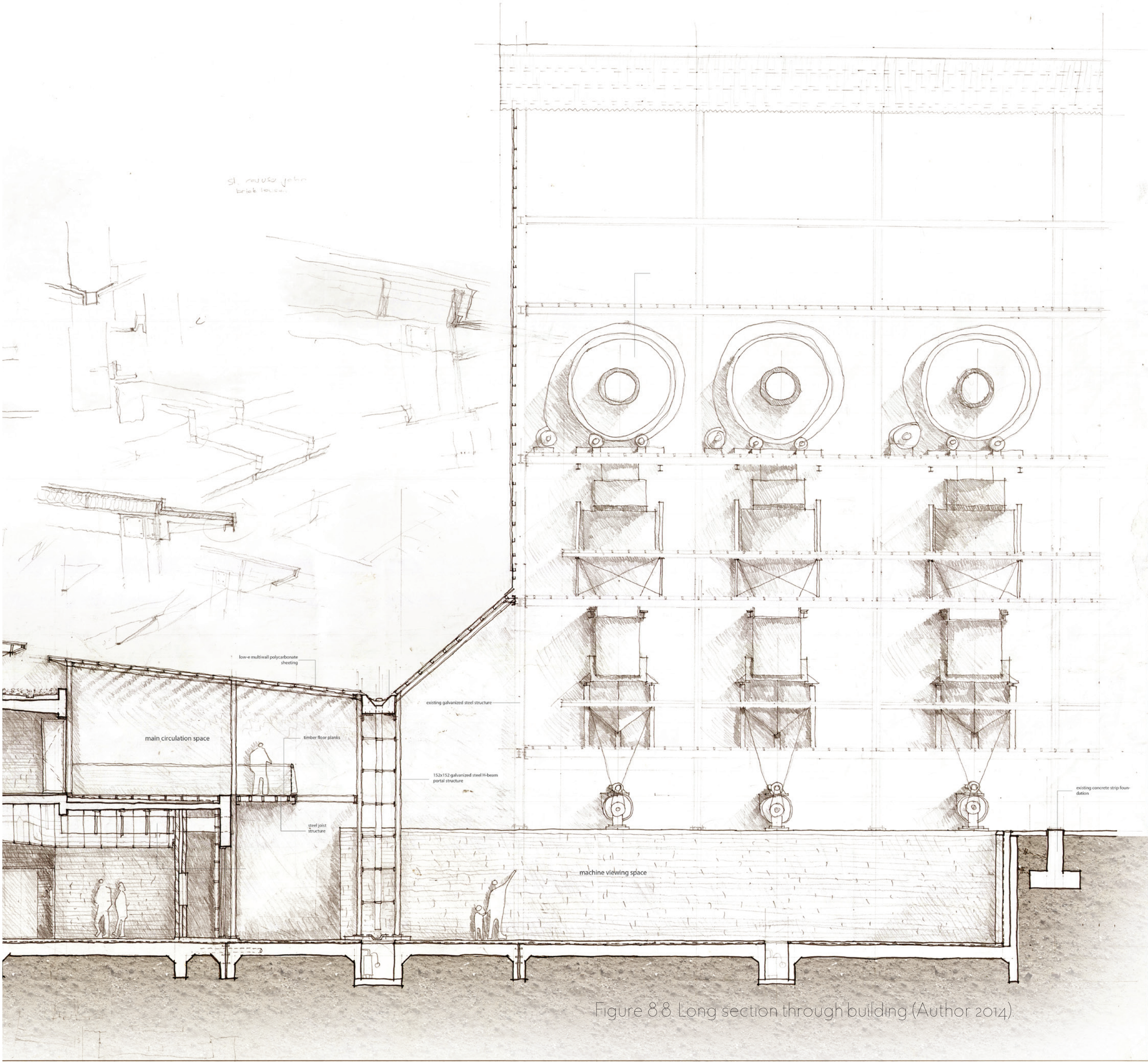


Figure 8.8 Long section through building (Author 2014)

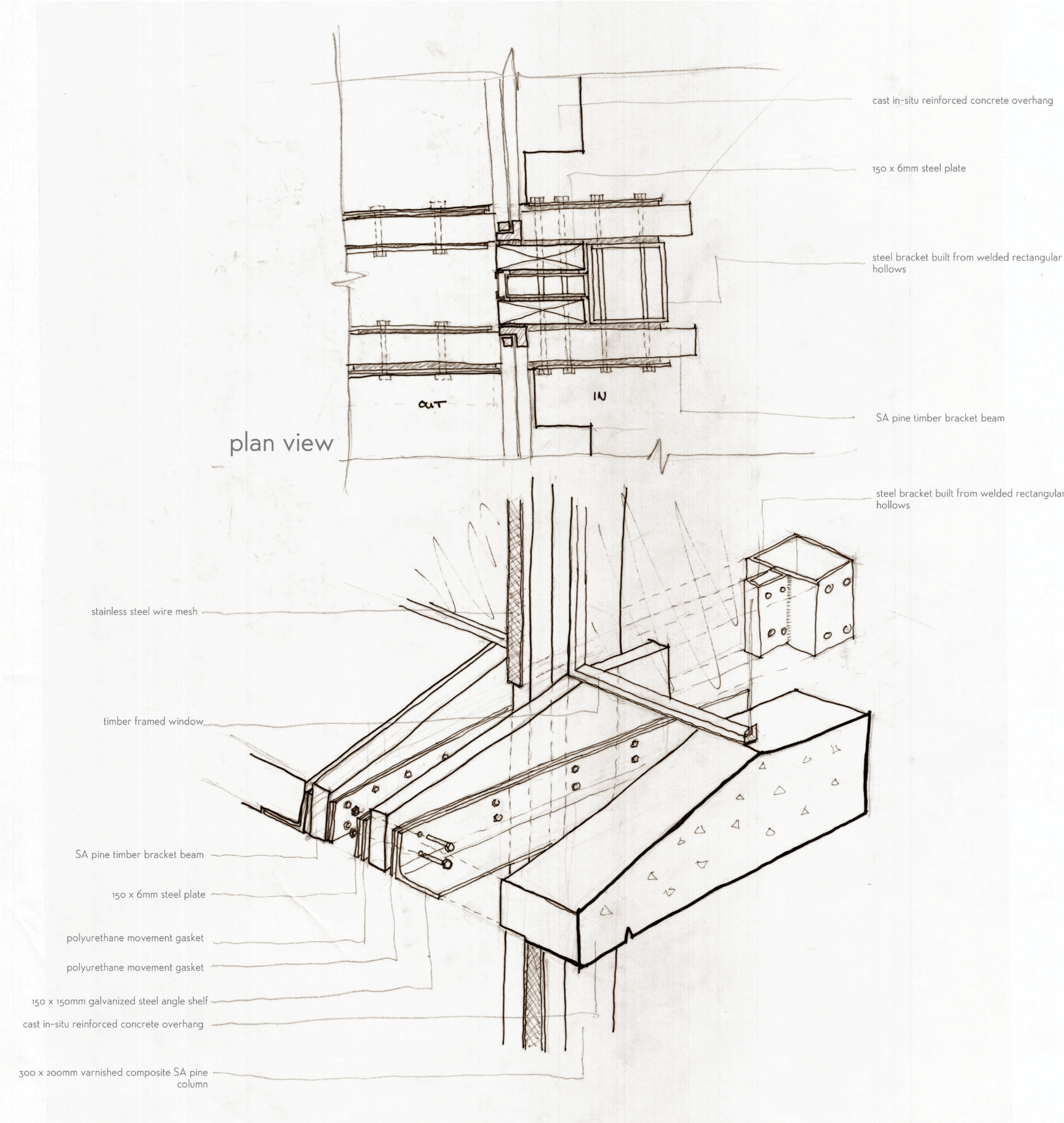


Figure 8.9. Detail of concrete overhang supported by timber columns (Author 2014).

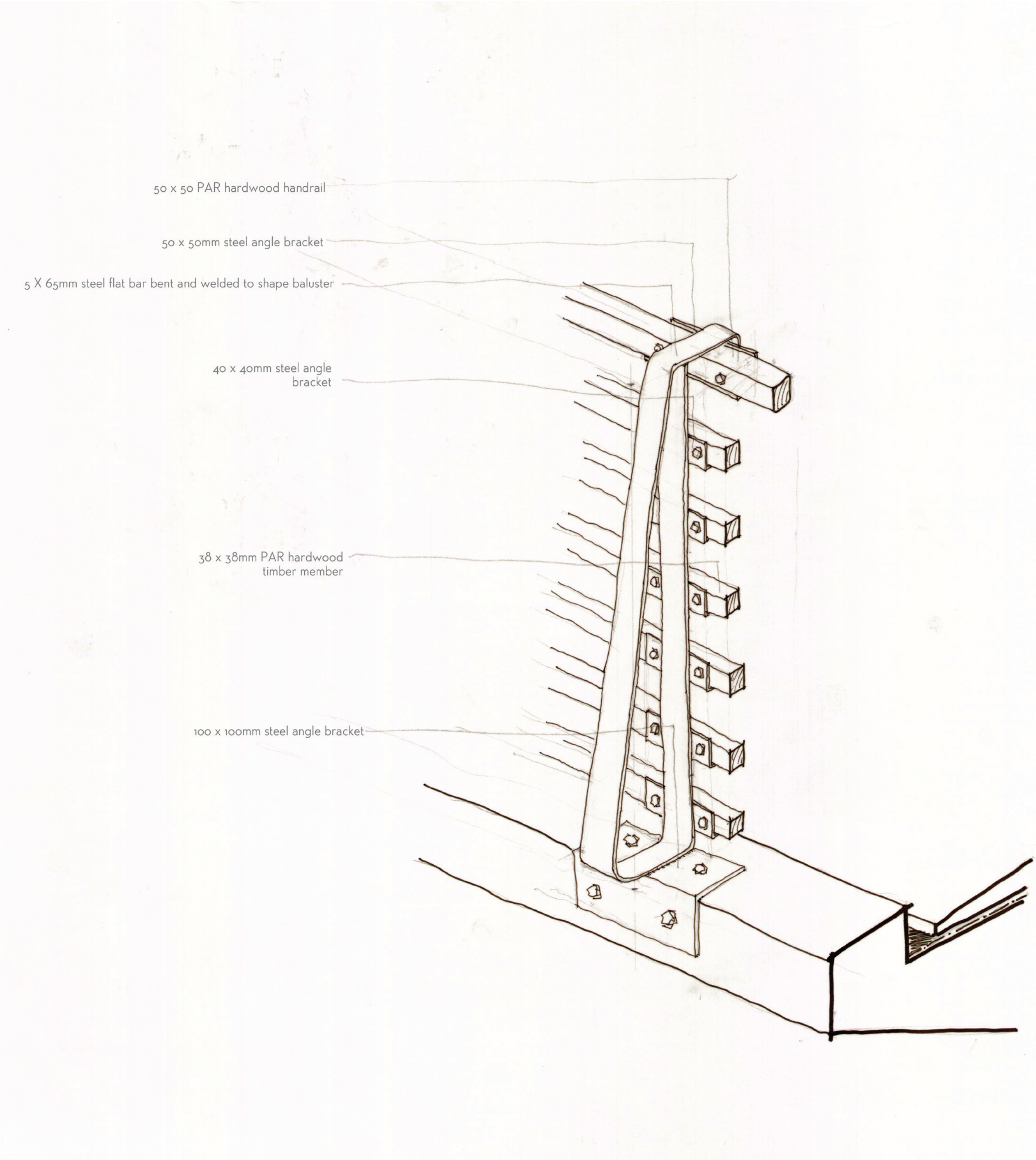


Figure 8.10. Balustrade detail (Author 2014).

List of Figures

References

Alpaco catering equipment. 2009. *Bakery equipment*. http://www.alpacocatequip.co.za/Heavy-duty-kitchen-utensils-boiling-pots.html. (Accessed on 19 September 2014).

Angel Investment Network. 2014. *Working towards a unique clay brick manufacturing company*. https://www.investmentnetwork.co.za/business-proposals/working-towards-unique-clay-brick-manufacturing-company-15-146854. (Accessed on 1 October 2014).

Australia ICOMOS Inc. 1999. *The Burra Charter (The Australia ICOMOS charter for places of cultural significance).* http://australia.icomos.org/wp-content/uploads/BURRA-CHARTER-1999_charter-only.pdf (Accessed 9 September 2013).

Ching, FDK. 2008. *Building construction illustrated*. Hoboken: John Wiley and Sons.

Daikin. 2014. *Destiny commercial indoor air handlers.* http://www.daikinapplied.com/air-handlers-destiny.php. (Accessed on 20 October 2014).

DiMuzio, DT. 2010. *Bread baking: An artisan's perspective*. Hoboken: John Wiley & Sons.

Duroplastic. 2014. *Multilite multiwall polycarbonate sheeting*. http://www.duroplastic.com/pdf/marlonst_brochure_eng.pdf. (Accessed on 20 October 2014).

Ernstson, H, van der Leeuw, SE, Redman, CL, Meffert, DJ, Davis, G, Alfsen, C & Elmqvist, T. 2010. *Urban transitions: On urban resilience and human-dominated ecosystems.* AMBIO 39:531-545.

Frampton, K. 1995. *Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture*. Cambridge Massachusetts: MIT Press.

Friends of the rail. 2014. *By steam train to Cullinan*. http://www.friendsoftherail.com/joomla/index.php/train-trips/information-for-passengers/67-by-steam-train-to-cullinan. (Accessed on 20 May 2014).

Gelernter, M. 1995. *Sources of architectural form: A critical history of western design theory.* Manchester: Manchester University Press.

Hagan, S. 2000. *A snake in the grass: ethics vs. aesthetics in sustainable architecture*. World renewable energy congress 4: 472-476.

ICOMOS. 2003. *The Nizhny Tagil Charter for the industrial heritage*. http://international.icomos.org/18thapril/2006/nizhny-tagil-charter-e.pdf (Accessed 24 May 2014).
ICOMOS. 2011. *Joint ICOMOS – TICCIH principles for the conservation of industrial heritage sites, structures, areas and landscapes*. http://www.international.icomos.org/Paris2011/GA2011_ICOMOS_TICCIH_joint_principles_EN_FR_final_20120110.pdf (Accessed 23 August 2013).
Lincoln, J. 2011. Stories from a diamond mine. South Africa: TCM.

MacKeith, PB (ed). 2006. *Archipelago : essays on architecture : for Juhani Pallasmaa*. Helsinki : Rakennustieto.

Penny, N. 1978. *Piranesi*. London: Oresko Books ltd.

Posner, ES. 1997. *Wheat flour milling.* St. Paul: American association of cereal chemists.
Premium kitchens. 2009. Refrigeration. http://www.premiumkitchens.co.za/pCUB250/CATERLOGIC-COLDSAVER-UNDERBAR-FRIDGE-560-25-DOOR.aspx. (Accessed on 19 September 2014).

Rheinzink. 2013. *Roofing: System solutions for roofs.* http://www.rheinzink.co.za/fileadmin/inhalt/bilder/ebooks/4545265950ff625e675fb/index_en.html. (Accessed on 10 October 2014).

RIBA, 2005. *The Bloomsbury pieshop*. http://www.presidentsmedals.com/Entry-16641 (Accessed on 25 May 2014).

Scribd. 2014. *Plant layout part 1*. https://www.scribd.com/doc/49241625/Plant-layout-Part-I. (Accessed on 20 May 2014).

Shangoni Management Services (Pty) Ltd. 2012. *Petra Diamonds, Cullinan Mine, Environmental Management Programme.* Pretoria: Shangoni Management Services (Pty) Ltd.

St John Wilson, C. 2007. *The other tradition of Modern architecture: The uncompleted project*. London: Black Dog.

Taljaard, CC. 2013. *New Era ceramics: A solvent for the industrial boundary* (dissertation). Pretoria: University of Pretoria.

Tolkien, JRR. 1955. *The two towers* (Audiobook). Inglis, R (Narrator). Prince Frederick: Recorded Books Inc.

UNESCO. 2011. *Recommendation on the historic urban landscape, including a glossary of definitions*. http://portal.unesco.org/en/ev.php-URL_ID=48857&URL_DO=DO_TOPIC&URL_SECTION=201.html (Accessed 23 August 2013).

United Milling systems. 2014. *Flour mill type 5*. http://www.unitedmillingsystems.com/aviva/media/drawings/type_5.pdf. (Accessed on 19 September 2014).

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

Wikipedia, 2014. *Caspar David Friedrich*. http://en.wikipedia.org/wiki/Caspar_David_Friedrich#mediaviewer/File:Caspar_David_Friedrich_-_Abtei_im_Eichwald_-_Google_Art_Project.jpg (Accessed on 25 May 2014).

Wikipedia. 2011. *The open pit – 2011*. http://en.wikipedia.org/wiki/Premier_Mine#mediaviewer/File:South_Africa-Cullinan_Premier_Mine02.jpg. (Accessed on May 20 2014).

Declaration

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this dissertation, which I hereby submit for the degree(s) of Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or other qualification.

I further declare that this thesis is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

Marcel Mattheüs
October 2014