

S P E C T R A L
F L E S H -
R E M E M B R A N C E

AN INVERTED MONUMENT AND FOUNDRY EMBEDDED IN THE DECOMMISSIONED
PELINDABA NUCLEAR WEAPONS SITE

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DECLARATION OF INVENTION:

This dissertation is submitted in partial fulfillment of the requirements for the degree Master in Architecture. All the work contained in this document is my own except where otherwise acknowledged.

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

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To my parents, for your never-ending support over the last five years, without whom this would never have been possible.

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To the anonymous source who gave me access to the site of this thesis, a prayer answered.

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Figure 1: On site sketch of the existing buildings (author, 2023).

ABSTRACT

The Angola-South African War left extensive scars and remains a raw place in the lives of many South Africans. Yet it has become a kind of suppressed memory that is hard to grapple with in the post-democratic reality, and the majority of South Africans choose to conveniently overlook the consequences of this conflict. The memory and memorialisation of the war has become a shrouded spectre. One of the most obscured facets of the war was the fact that South Africa managed to construct nuclear weapons, and (even more astoundingly) became the first nation to voluntarily decommission their nuclear arsenal. In the wake of ghost-like memories of the past, the question arises:

How can a spectral architecture mould out of the core witnessing experiences of those discarded machined souls and soulless machines entangled in the obscurantist mindset that birthed the nuclear weapons programme at Pelindaba in the context of the Border War?

Those in power, too, choose to forget the haunting effects in the hearts of those conscripted into the war and the suffering enforced by it. The manifestation of this amnesia-like state comes in the form of the nuclear weapons site, rusting and forgotten. Through a symbolic repurposing of decommissioned firearms in a foundry and the remembrance of spectres from the site in an inverted monument, a design is proposed as a means to reveal the forgotten and censored. The exposure of restricted historical documentation is part of the outcome of this research; to find what is still prevailing of something that no longer officially exists and document the remaining structures. Regarding placing architecture and conflict in context, special care is taken in analysing precedent studies of the built form as well as structural theory of 'the form in conflict' with a morphology responding to place as much as process. The proposed architecture of structure, relating to spectral remembrances of the flesh, attempts to explore the role architecture can play as a mediator and reminder of forgotten conflicts.

PRETEXT

The research in this paper documents an investigation into conflict and forms of conflict relevant to the historical context described here. My initial interest in this topic came from a personal fascination with how architecture responds to and is formed by organised conflict, specifically warfare. The 'nuclear' word is voiced with greater concern in times of war. Yet many forget the implications this word has and how these weapons have changed behind the backs of the public.

Secrecy and the shadowy nature of information surround South Africa's previous nuclear weapons programme. Details of the programme have never actually been released, even if the administration claimed to do so at the time, and the information that has been declassified is redacted beyond readability. The majority of available information comes from third-party sources and declassified documentation from other intelligence agencies not belonging to South Africa. As well as serving as a theoretical architectural exploration, it is my goal that this research can contribute documentation to the demystification of the nuclear weapons programme that was conducted in the 1970s and dismantled in the early 1990s. Difficult to remember terms relating to the history and context of this thesis can be found in the conclusion chapter and can be referenced at any point.

As part of engagement with the context of this thesis, a letter accompanies each chapter (except for the foundation chapter) to reveal and highlight certain information pertaining to the contents of that chapter and the program as a whole. The letters are written as if the foundry were actually in the process of being built, as well they are replica letters of letters that were found in the Cape Town national archives during research regarding the construction of the Koeberg power station. It is assumed that many such letters were written regarding the nuclear program, but those have not been disclosed to the public. The letter header, footer and layout are almost exactly the same as the original except for content and branding. The Afrikaans titles are copied as well, which makes a small reference to the fact that the entire nuclear program was conducted and documented in Afrikaans.

It must be noted that research into this programme has been exceedingly difficult due to the restriction of information. The opportunity to conduct a site visit and take photographs is so implausible as to itself be a breakthrough in research into the history. A permanent record of the existing structure has been laboured upon to contribute to history through this thesis. The discovery of the current state of the site is fascinating to compare with the last public record of the buildings taken in the early 2000s.

In striving for an appropriate response to the site, the focus remains around what remembrance is left on site and in the minds of contemporary society. That unforgettable essence is what plagues the past, and it should not be ignored. The difficult politics of 'why' should never erase the memory of the people that it happened to. Forgetting the decay is part of the decay itself.

Although this thesis serves to remember, it does not serve to memorialize the actions of the past. It is the human experience and way in which our existence is tied to these themes that we must never forget. Part of the research is to investigate how, once developed, technological mechanisation changes how we view the world; a post-phenomenological look at our past. Additionally, the research aims to look at the concept of concealment and how this might reveal further investigations.

How differently one feels when holding a firearm. How differently did South Africa feel possessing the nuclear bomb?

The moment South Africa's nuclear weapons programme became public, three years after the last bomb was dismantled:

“Any doubt about the Government’s intentions with regard to nuclear matters must, for once and all, be removed. For this reason, the Government has decided to provide full information on South Africa’s past nuclear programme despite the fact that the NPT [Nuclear Non-Proliferation Treaty] does not require this.

At one stage, South Africa did, indeed, develop a limited nuclear deterrent capability.

The decision to develop this limited capability was taken as early as 1974, against the background of a Soviet expansionist threat in Southern Africa, as well as prevailing uncertainty concerning the designs of the Warsaw Pact members.”

– F.W. De Klerk (1993)

CHAPTER 01

FOUNDATION



Figure 2: The Pelindaba site (AEB, 1976).

1.1 HALF-LIVES OF MEMORY

The memorial exists somewhere between a land anchor and a disposition of memory. It serves to place a marker in time and create a condition which one can never forget. It is a condition of physical place centred around the specific remembrance of an event. The memorial differs from the monument. It does not serve as a marker to an heroic triumph or great act of our hands. It recalls past deaths and horrifying events that we may remember and mourn. However, the space is not one-sided. Once created, the space can be reborn unto itself. Created in the image of one state's ideals, a memorial can become something other than it was intended to be in the first place when people no longer see the same point of view as the state.

The sins of the father remain as memories, concretized only in the minds of the nation. Individuals are their own memorials, soft tissue and bleeding flesh. In these vessels the past is recalled. That silent period of memory, where the nation set about to define borders and lines between groups, is a deep scar in the psyche of the South African and the others afflicted by it. Guilt, denial, hatred, judgement, conflict and cold silence plague thoughts of this past — the gnawing that creeps into all those hearts. This is how minds become their own memorials of the past, remembering what was and this remembrance being what each one makes of it.

The ways in which one remembers these kinds of things are important. The 'cerebral memorialization', the memories that are only left in individuals, of the war and the nuclear programme, leaves a flesh-like form of remembrance when remaining unspoken. Flesh degenerates and wastes away, an uncomfortable truth but one that remains, and even though flesh decays, the past remains in its unchanging nature.

The Border War ended without conclusion. Both sides claim victory, but the loss is evident on all levels. It was a war that both sides lost. The end of the conflict brought about almost no outcome but left decay in the hearts of those involved. The events of the past left the lasting decomposition that consumes the souls of those left behind. Many hearts walk with the silent weight of gunfire still ringing in their ears, discarded after use, left to continue as if it never happened. As if it never happened.

Similarly, the bomb was constructed in secrecy and silence while those on the border toiled to the whims of government. The quieter scientists, physicists and technicians created the conditions for the deafening roar of weapons of mass destruction; a critical experiment performed, a test of which the true outcome is not wanted, yet still searched for. The nuclear programme that cost millions was later surgically dismantled and the documents allegedly destroyed, leaving only the personnel and structures that housed them (Figure 3). The material used to construct these weapons was kept after decommissioning. Deafening silence from those in power combined with a forgetful memory of the past.

The research here aims to capture something elusive that exists between memory and the memorialisation of this conflict. There is something ghost-like that haunts the mentioning of the topic. Therefore the remembrance of the nuclear weapons programme should not be cut out from the context of its time. The conditions that brought about its invention are strafed with scars of borderlines and the decisions of a state far too concerned with conflict.

A 'memorial' based on the site of nuclear weapons development must be framed by the 'borders of history' not forgetting the decaying hearts and minds that lie all around. A memorial is an anchor in time calling forth confessions to withstand ever-shortening radioactive half-lives of memory to both bear witness and bear silence. It is a remembrance that no one person can lay claim to. It is, necessarily, a collective and shared history. Even though all individuals will subjectively interpret experiences before them, no memorial can completely dictate a memory.

While some built form of memorialization does exist of this conflict, much of it only dwells in the minds of those who were affected by it. We should not be our own memorials of the past, and those events so ever bonded should not be lost to un-recollection.



Figure 3: The forgotten formations of the past (author, 2023).

1.2 SITE

The proposed site is South Africa's ground zero of nuclear weapons development and testing located in the valley below Pelindaba (Figures 4 and 5) and run by the Nuclear Energy Corporation of South Africa (NECSA). The site was originally chosen due to its hidden nature and "terrain masking" (Albright and Stricker, 2016: p30). The site mainly saw the development of nuclear weapon-type designs and criticality experiments done to test the potential yield of highly enriched uranium (HEU), which is an essential step in nuclear weapons development.

The buildings, abandoned for many years since the programme's end in the early 1990s, were left in disrepair. Through satellite image analysis and a site visit, it was discovered that some of the structures have been partially demolished. Although the other structures are in use and well-kept, they too have been subject to small changes over the years subsequent to their original use.

What does a place remember? The Pelindaba site is endowed with various obscured histories. It remains a place of secrecy. Censorship and redaction surround most information regarding the programmes of its past.

The nuclear weapons programme is shrouded in dark closure. The site remains one of the few uncompromised witnesses to the past events. As such, it could be used as a concrete opportunity - an "existential foothold" as the Norwegian architectural theorist Christian Norberg-Schulz put it (1980: 5) — to come to terms with the deeply problematic aspects of our past; a heritage resource which, in its mundaneness, speaks volumes about the banal bureaucratic systems that often underpin war efforts. No matter how difficult it is to uncover facts, it must be remembered and interpreted in a way that uncovers the layers of information obscured by the previous regime.



Figure 4: The restricted site, the first glimpse, building 5000 (author, 2023).

1.3 THEORETICAL CORE



Figure 5: Post-nuclear scars of the site, the second glimpse, building 5100 (author, 2023).

There is a fundamental difference between a flesh-witness and an eye-witness that people usually fail to understand regarding veterans of conflict as defined by Gary Baines (2014: 23). The knowledge gained through eye-witnessing and observation is factual and can be quite easily transmitted to other people. In contrast, a flesh-witness can never really transmit his or her knowledge to other people. These individuals cannot fully describe what they witnessed, and the observer cannot fully understand (Baines, 2014: 24). This gap is becoming even more prevalent in contemporary society when most people eye-witness war via media broadcasts without ever flesh-witnessing it.

An essential part of the war veteran's flesh witnessing is captured in their relationships with technologies of war. In order to best understand the implications of this kind of flesh-witnessing, a post-phenomenological approach will be followed.

The technological development of combat changes the soldier. Interestingly, despite providing a window into the technology-mediated flesh-witnessing of war, this post-phenomenological occurrence is reflected when considering the larger picture of the war and the country at the time. The one who holds the bomb and the one who holds the gun are both changed entities. How these effects choose to manifest over prolonged periods of neglect opens compelling design opportunities when applied in the architectural context of buildings responding to conflict.

I.4 PROGRAMME

The brief is constructed from two main components connected by a third:

Decommissioned Firearms Disposal
| Spectres Of The Border War |
The Nuclear Program Exhibition

The proposed programme unfolds in concert with the layout and nature of the site and its scattered buildings. The two main systems that run in conjunction, the nuclear memorial and the foundry, are proposed to be designed through the adaptive re-use of two of the key buildings where nuclear tests and the administration of the programme took place. These memorialising foci are connected by a peripatetic inverted memorial providing choreographed opportunities for reflection on the Border War.

The foundry contains the most technical processes and must adhere to a stricter approach in the design of the functions held within. The basic function of the foundry is to create a dedicated facility for firearm disposal. South Africa houses no specific facility for the disposal of firearms and the metal is merely cast with a multitude of other scrap metal (Mercury, 2020: online). The lack of a dedicated firearms disposal facility means that current illegal and decommissioned weapons are taken to general-purpose scrap metal recovery plants and melted down there. This poses a safety concern as proper security has not necessarily been established in these places to deal with the disposal of firearms. Additionally, these ‘weapon dumps’ are carried out once a year (Mercury, 2020: online) with extensive quantities of these firearms being transported and delivered at once, which makes accountability difficult.

A metal works facility that is designed to take smaller incremental loads of decommissioned weapons (Figure 6) into the foundry can provide better security in a dedicated area for disposal. In addition, by producing a metal derived solely from firearms, it creates a very specific ‘precious’ metal. It is proposed that this kind of repurposed metal will be cast into moulds for construction joints. These joints will be used in the design of the Nuclear Programme ‘Memorial’ and Border War conjoining structures, thus transforming that which is intended for destructive decay into elements created for bonding structure.



Figure 6: The disposal (Mercury, 2020).

The nuclear ‘memorial’ aims to sensitively attach a structure in and around the existing buildings. Due to the lack of knowledge of and public exposure to the history of the nuclear weapons programme, the new form is meant to represent a ‘drawing out’ of the hidden nature of the site. A respectful approach is taken to the historical buildings while also attempting to show the buildings from hidden angles. The production of the foundry is mimicked by the second building, but it houses a redacted process with an entirely unknown outcome to the viewer.

The purpose of the new nuclear memorial is to display the unclassified yet heavily censored information about the programme from the different agencies tracking its development since the mid-1970s. All official information is either stored secretly by South Africa and the International Atomic Energy Agency (IAEA) or has been destroyed, likely the latter. However, there has been one artistic exhibition and exploration into the remnants of the programme and its history by Vincent Bezuidenhout.

The exhibition showcased self-censored photographs of the site and documents released to the public. The collection captures an intrigue prevalent in all aspects of the site and the conditions surrounding it. The new structure intends to house this kind of exhibition, reflecting the ghosts of memory left in the programme’s wake.

Part of speaking to the ghosts of the past is to address the context of the nuclear programme and understand why it was developed in the first place. Although this research is firmly involved with remembering the nuclear weapons programme, the submerged body of the project is really the connection and context of the Border War. This becomes a less prominent aspect of the built architecture but a vitally important remembrance.

How this remembrance is shaped is delved into later in this thesis. The solid core of the programme exists within the spectral lines between the nuclear memorial and the foundry (Figure 7). This is where, within the programme, the contextual placement of formations of remembering the Border War is cast.

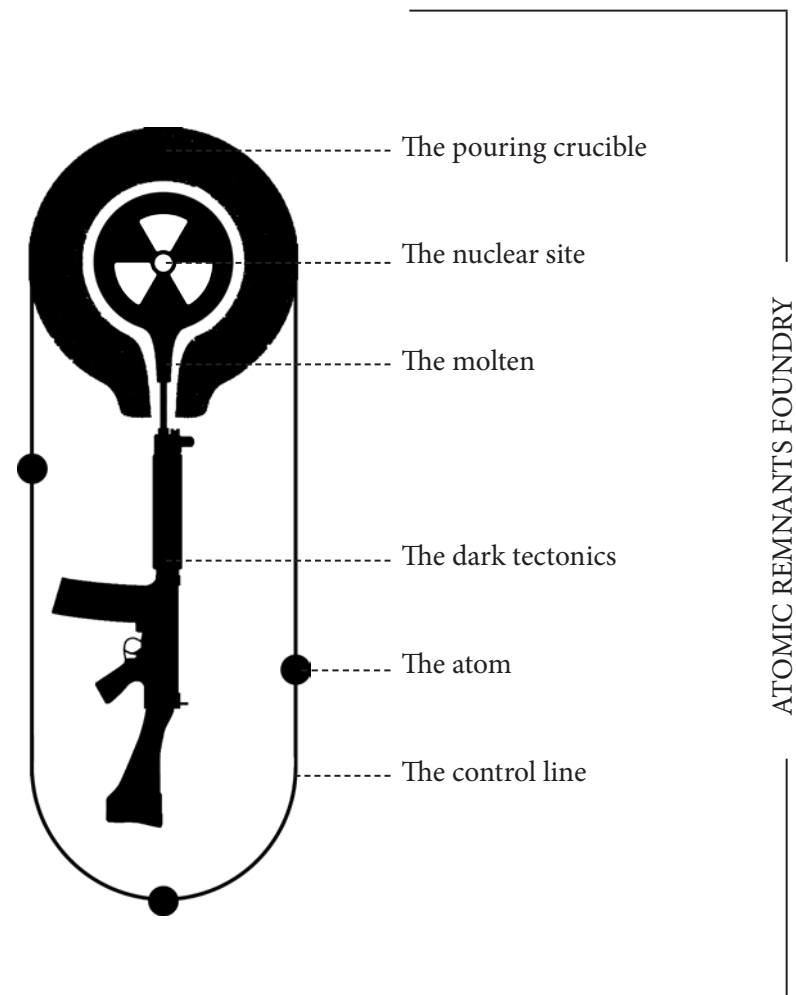


Figure 7: ‘ARF’ logo based on original Atomic Energy Board logo (author, 2023).

1.5 RESEARCH QUESTION

The research question attempts to connect phrases and concepts of this project to bring together a leading question that is not meant to be answered directly but rather to prompt a structural response from which a building can be drawn:

How can a **spectral architecture mould** a place of **inverted memorialisation** out of the core **witnessing experiences** of those discarded **machined souls** and **soulless machines** entangled in the obscurantist mindset that birthed the nuclear weapons programme at Pelindaba in the context of the Border War?

1. **Spectral architecture:**

So much of the nuclear weapons programme only exists as a ghost-like memory. The buildings, demolished and intact, are empty of their built purpose, leaving a shadow of what was truly there to begin with.

2. **Mould:**

This refers to the metal melting and casting process and how a form can be created through the influence of the mould it is poured into. In a way, place is like a mould and true architecture is poured as a molten liquid into that mould to take form.

3. **Witnessing experience:**

Military experience, especially combat, is invested with 'privileged' knowledge. These individuals become 'flesh-witnesses' of their experiences. This is the concept of physical remembering both through the Border conflict and the nuclear programme.

4. **Machined souls:**

Those who were conscripted and those who were forever changed by the Border War. The military machine produces people of mechanical quality, to perform in the greater mechanism of war.

5. **Soulless machines:**

The mechanics and technological advancements created due to the advent of war. Organised conflict brings the rapid development of machines to overcome these challenges.

1.6 CONCLUSION

The conditions of conflict lead to difficult realities of the built form as well as when building form to remember it. Monuments and memorials are the traditional experience of buildings designed to remember. The Border War created a unique context in which South Africa developed. Unlike in Angola where tanks and remains of warfare litter the landscape, South Africa has little physical fallout of memory to trigger reflection. The site of nuclear weapon development is a reminder of the conflict and a forgotten fragment of the past few seem to even know about.

The intention of this thesis is not to memorialize the old nuclear programme, rather the following work delves into what remains of it and what the built-form of remembrance of the Border War is today. By no means does this work pretend to represent the experiences of those who fought in The Border War. This thesis is an attempt at a sensitive acknowledgement of the difficulties of remembering these events. The challenging post-political conditions should not erase the people that it happened to.

The next chapter unpacks the history and context in which the events of the nuclear weapons programme were created, and further analyses the site, establishing the critical link between the nuclear programme and the conditions of its history.

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CHAPTER 02

CONTEXT

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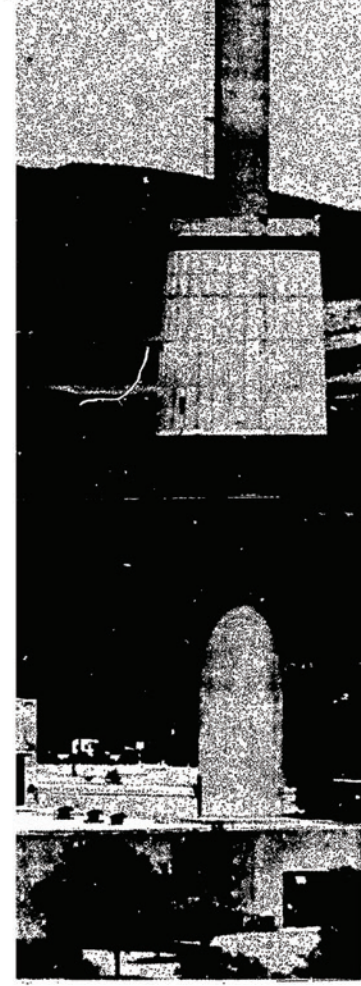


Figure 8: SAFARI-1 reactor building (AEB, 1976). 11

2.1 INTRODUCTION

In 1993 South Africa publicly announced it had developed, and disassembled, a nuclear weapons deterrent programme (De Klerk, 1993), becoming the first — and to date only — country to have done so. The dismantlement was of the weapons themselves as well as all of the capability to produce them. Since this announcement, the government has developed a silent voice and convenient forgetfulness of the programme. Even though it was announced and some amount of information was allowed to be publicly known, most of the details of the programme have been left in secret, with a few private organisations and individuals revealing some details. The nature of this silence leads to speculation and misunderstanding of what really happened in public perception.

It is not the goal of this thesis to go into extreme detail about the physics of the programme nor politics of the time, but some overview must be delved into. Much of the nuclear weapons programme is left to conjecture, and what information is accessible about the programme has been pieced together from various sources. Due diligence has been done to ensure that there is as little misrepresentation of facts as possible. Details and explanations of the conditions relating to the site and the history of relevant subjects around the nuclear programme are important discussions to demystify as much as possible. Without the preview of contextual events, the nuclear programme is surgically removed from the conditions of the time and assessments of decisions made during the time are placed inside a vacuum that could lead to further facades of information.

C05830442

Figure 6
The 22 September 1979 Event

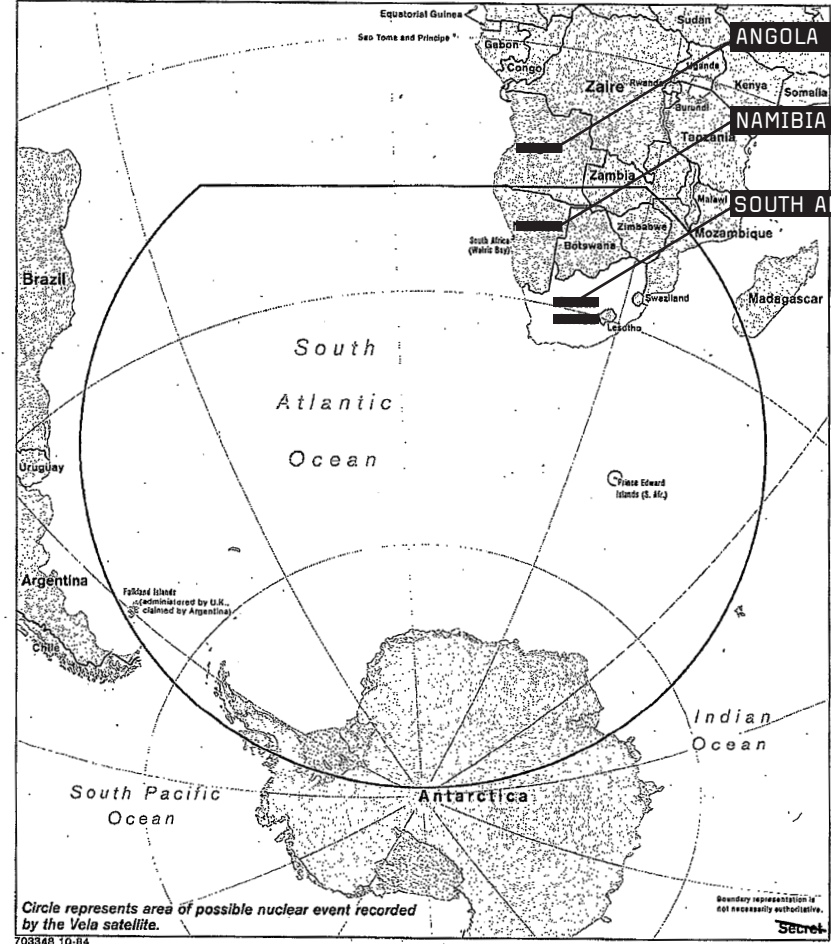


Figure 9: South Africa in relation to international conflict (CIA, 1984).

2.2 SUCCESSION

In order to review the nuclear posture fully, it is imperative to understand the perspective and context of those in control of the programme at the time. In *Nuclear Armament and Disarmament* (2007), Richardt Van Der Walt, General Manager of the Atomic Energy Board, Hannes Steyn, General Manager of Research and Development at Armscor, and Jan Van Loggerenberg, Chief of the South African Air Force, go into detail about their experiences and the development of the programme as well as explaining the historical context.

Shortly after World War 2, the world found itself in a war without direct conflict, a cold war. In many ways, this was a battle of ideologies between the 'traditional West' and the new 'Communist viewpoint'. This 'Cold War' saw a race for development between the major players in the conflict, and much of the competition between the United States and the former Soviet Union manifested in a technological and weapons race for advancement. The results of the Cold War are incredibly complicated, and the effects of it are still felt to this day. This is part of the context that South Africa was situated in on a global scale.

Starting in the late 1940s, South Africa found itself accused of two separate issues by the United Nations (UN) organisation (Styen et al, 2003: 2). The first was the racial discrimination from the apartheid policy implemented in the country that caused the suffering and human rights violations of millions of South African citizens. This manifested in many ways. One example of this was the 1960 Sharpeville protest against apartheid ending in a massacre. A combination of all these events led the UN to implement punitive actions against South Africa in a call to ban "all arms and ammunition" (Styen et al, 2003: 2). Interestingly, when United Nations Security Council Resolution 282 was adopted, France, Spain, the United Kingdom and the United States abstained from signing. Certain powers continued to sell military transport vehicles and aircraft to South Africa, arguing that these systems could not be considered "arms". This trade continued until United Nations Security Council Resolution 418, which was adopted unanimously and was a mandatory arms embargo (UN Security Council, 1977: online), but this will be further discussed later.

The other issue discussed by the UN was that of South West Africa (now

Namibia) and disputes over its status (Figure 9). The territory was under the administration of South Africa by order of the League of Nations after the colonial rule of Germany that ended in 1915 (SAHO, 2011: online). At one point South Africa proposed to the UN to incorporate South West Africa (SWA) as its fifth province at the time (Styen et al, 2003: 3). The proposal was rejected, and the dispute for the status of SWA continued in a long and protracted struggle.

At the same time, the Cold War continued to rage between the East and the West. While the general attitude was to try to avoid world wars and local wars, the Union of Soviet Socialist Republics (USSR) stated that "...there [was] no longer any force in the world capable of barring the road to socialism." (Styen et al, 2003: 3) and declared a will for "national-liberation wars". This attitude from the USSR saw a growing interest in supporting the African bloc and recognition of the benefits of forging close ties with these countries. When the Portuguese occupation of Angola ended in the mid-1970s, the USSR was quick to involve itself in the situation.

The simmering conflict between Portuguese and rebel groups reached a sudden escalation in 1974 when the dictatorship in Angola was overthrown by a group of army officials, as described by the renowned South African historian and writer Leopold Scholtz (2020: 7). The instability preceding the Portuguese departure and thereafter offered an ideal opportunity for the Soviet bloc to establish a foothold south of the Equator in Africa (Styen et al, 2003: 3). Although the situation in Angola and historical analysis is highly complicated, it essentially resulted in a civil war within Angola being supported by either side of the Cold War, the US and the USSR. It was, in some ways, a proxy war.

The contending movements to the civil war within Angola were the People's Movement for the Liberation of Angola (MPLA), the National Liberation Front of Angola (FNLA) and Unita (National Union for the Total Independence of Angola). Initially, after the Portuguese collapse, there was an attempt at elections, but things quickly descended into chaos between the groups (Scholtz, 2020: 8). The South African Defence Force (SADF) was involved in conflict along the border between SWA and Angola and inside SWA from the early 1970s. In 1973 F.W. De Klerk said, "...for a long time already, we have been engaged in a war of low intensity and that situation will probably continue for some considerable time" (Walters, 1987: 66).

At this stage the outside world began meddling further, turning this into a theatre for the Cold War. The United States (US) and France provided controlled support to the FNLA but the Soviet Union and Cuba intervened heavily on behalf of the MPLA (Scholtz, 2020: 8), and 1975 saw the arrival of thousands of Cuban troops (Styen et al, 2003: 5) (Figure 10). In Scholtz's words (2020: 8), "egged on by the US and by several African states, South African invaded Angola clandestinely to put Unita and the FNLA in a strong negotiating position." In addition, the unstable security situation in Angola posed a perceived threat to South Africa, and tension was further raised by infiltrations of the South-West Africa People's Organization (SWAPO) into SWA (Styen et al, 2003: 5). This resulted in South African troops (Figure 11) engaged in hit-and-run guerrilla warfare through Angola and into SWA. These were the proverbial 'opening shots' of the long drawn-out conflict of the Border War which lasted into the late 1980s and cost many lives on both sides.



Figure 10: The first Cuban involvement in Angola (Venter, 2019)



Figure 11: SADF across the border in Angola (Venter, 2019).



Figure 12: Bombed out structures of the border (Venter, 2019).

This is the context in which the nuclear weapons program of South Africa was established (Figure 12). Military correspondent and South African writer Al J. Venter (2008: 44) maintains the widely accepted view as to why South Africa built its atomic bomb based on a number of premises, the most important of these being the Soviet expansionism in Africa and the perceived threat of this by the government at the time. The conception of the nuclear weapons program certainly formed within the conditions of the Border War, but the application of the bombs is a much more complicated matter than simply using the bombs in warfare. The programme was created under the three-fold basis that South Africa should have a credible nuclear deterrent, that it would deploy this deterrent in the most responsible way possible, and that it would limit the size of the programme according to the threat (Styen et al, 2003: 13). The deterrent strategy is best understood in the phases that South Africa intended to utilise the bombs (Venter, 2008: 105):

- **Phase one:** ‘Strategic uncertainty’, where South Africa’s nuclear capability would be kept in speculation and neither acknowledged nor denied.
- **Phase two:** Should territory be threatened militarily, the government would secretly acknowledge the existence of the programme to the US in particular to gain assistance in defusing conflict.
- **Phase three:** If the partial disclosure failed to instigate aid from the West, they would publicly acknowledge its capability and demonstrate one of the weapons in an underground test.

This is the fundamental concept of nuclear weapons as a deterrent, that they essentially become a political tool to manoeuvre upon the world stage. The idea of nuclear deterrence as a defensive measure to combat conflict is a relevant topic. In the past, war was often waged between countries when one could justify the cost against what they might gain. Conventional explosives and weaponry offered limited potential for destructive capability, and therefore conflict appeared as a worthwhile gamble in certain circumstances. That risk became a whole lot more dangerous once the nuclear atom was released, as seen in the cost Japan tragically paid after taking on such a venture of conflict in the Pacific. This dynamic of deterrence continued to define the Cold War after the invention of the atomic weapon.

The first step in the deterrence strategy of the West was to ensure that the enemy would not be able to destroy the reserve of weapons in any single attack (Styen et al, 2003: 12). This meant diversifying delivery systems into ground-based ballistic missiles, aircraft systems and submarine-launched ballistic missiles. Through this strategy taken by the West and East, by the end of the 1980s it is a safe assumption that neither side was able to destroy the other's formidable arsenal without some form of retaliation from the other side. Additionally, there needed to be a physical capability and moral resolve to actually convince the other side never to cross that line. These are the conditions that led to the arms race throughout the long Cold War and ended in the collapse of the USSR. The history of warfare can be described as the development of measures to maximise organised violence and the following response of counter-measures (Styen et al, 2003: 62), an arms race.

On the hot front of the Cold War (Figure 13), the US eventually withdrew its support and arms sanctions tightened around South Africa, isolating it from the rest of the world. Fascinatingly, even though South Africa had sanctions imposed upon it in the 1960s due the gross human rights violations happening within the country, many countries kept dealing with South Africa until 1977 when it was alleged by Russian spies that South Africa was about to test a nuclear bomb. In David Albright's words, the head of the Institute for Science and International Security (ISIS), (2018: online) "...an alarm went off

worldwide that South Africa was getting ready to test a nuclear weapon [and the world reacted swiftly]". The embargos had been in the works for a while, but the discovery of a test site in 1977 by the Russians (who subsequently told the US about the suspected location) tipped the UN into passing United Nations Security Council Resolution 418 (Albright, 2018: online). The ban was made mandatory by the UN and unanimously appointed.

In summary, South Africa's nuclear weapon programme was developed under unique circumstances. The War in Angola was not the only reason for the birth of the programme; some consideration should certainly be given to the fact that the 'technological know-how' was an obvious progression in the Atomic Energy Board's natural scientific discovery. However, the war seems, by all sources, to be the most important of the factors involved. In revealing the story and programme, it should not be cut out of its context.



Figure 13: Targeted and bombed bridge in Angola showing structure physically changed through conflict (Venter, 2019).

2.3 THE NUCLEAR MACHINE

While things simmered on the Angolan border, the scientific investigation into atomic weaponry progressed within South Africa. The following gives a rough outline of how some of the conditions within the country transpired to evolve into the nuclear programme. The actual happenings are so complicated that they could never be fully described here, and many of the details are still secret. What is described is based on the testimony of those involved and the little documentary evidence left.

It is often asserted that the construction of a nuclear weapon is a straightforward task and that any reputable university would be capable of producing a nuclear bomb. However, this assertion is inaccurate (Albright, 2018: online). The process of constructing a nuclear weapon involves numerous challenges and demands extensive technical expertise and physical experimentation. While the assembly itself may be relatively simple, the tolerances and precision required for the device to function as a nuclear bomb are extremely stringent.

South Africa's research into nuclear weapons, which can be traced back to the aftermath of World War 2, bears resemblance to the events that led to the Border War. During this period, the US Manhattan Project, a covert programme aimed at nuclear physics research and the development of atomic weapons, made a significant discovery of substantial uranium reserves in Southern Africa (Albright and Stricker, 2016: 1) (Figure 14). Notably, South Africa's programme shares certain similarities with the Manhattan Project, and later sections of this paper will delve into specific aspects of the Manhattan Project that were declassified that lend context to the South African programme.

Both South West Africa and South Africa were identified as regions possessing valuable uranium deposits (Albright and Stricker, 2016: 1). Following an extensive investigation, South Africa successfully established uranium extraction plants, with sixteen mining facilities operational by 1955. This development positioned South Africa as a prominent supplier of uranium for other nuclear weapons programmes worldwide (Albright and Stricker, 2016: 1). To oversee the development of nuclear science in South Africa and the expanding uranium mining industry, the Atomic Energy Board (AEB) was established in



Figure 14: The first mine shaft in South Africa to exploit uranium deposits (Newby-Fraser, 1979).

1948 (Styen et al, 2003: 31). The AEB, which has since been rebranded as the Nuclear Energy Corporation of South Africa, continues to operate the same facilities as its predecessor.

In 1960, the AEB acquired the Pelindaba site to accommodate the growing needs of its economy (Albright and Stricker, 2016: 4). The selection of Pelindaba was based on its relative isolation, which ensured safe reactor operations, as well as its proximity to population centres with access to electricity and roads (Albright and Stricker, 2016: 4). Furthermore, Pelindaba's location near the Crocodile River, a vital water source, provided the facility with essential water supplies.

Even prior to acquiring the Pelindaba site, the AEB procured a research reactor from the US (Albright and Stricker, 2016: 6). The SAFARI-1 reactor (Figure 15), commissioned in 1965 and still in operation today, utilises weapons-grade uranium, which denotes enriched or refined uranium fuel. This highly enriched uranium (HEU) is also utilised in the production of nuclear weapons.

Following the training of scientists abroad, the AEB initiated discussions about establishing its own uranium enrichment plant, which constituted its ultimate objective (Albright and Stricker, 2016: 7). The enrichment process is highly complex and challenging, often more intricate than the assembly of a nuclear weapon, acting as a barrier for those seeking to manufacture uranium-based atomic weapons. The process involves the high-speed separation of elements within a cylinder, causing uranium isotopes to part themselves and be collected as HEU.

Considering the sensitivity of the political landscape and the potential implications if South Africa were perceived to be producing HEU, the uranium enrichment project remained classified (Albright and Stricker, 2016: 8).

As time progressed, and due to South Africa's isolation, the enrichment process was deemed crucial for the continued operation of the SAFARI-1 reactor which produced medical isotopes and served as a test reactor, as well as for fuelling future projects like the Koeberg Power Station (Styen et al, 2003: 34).

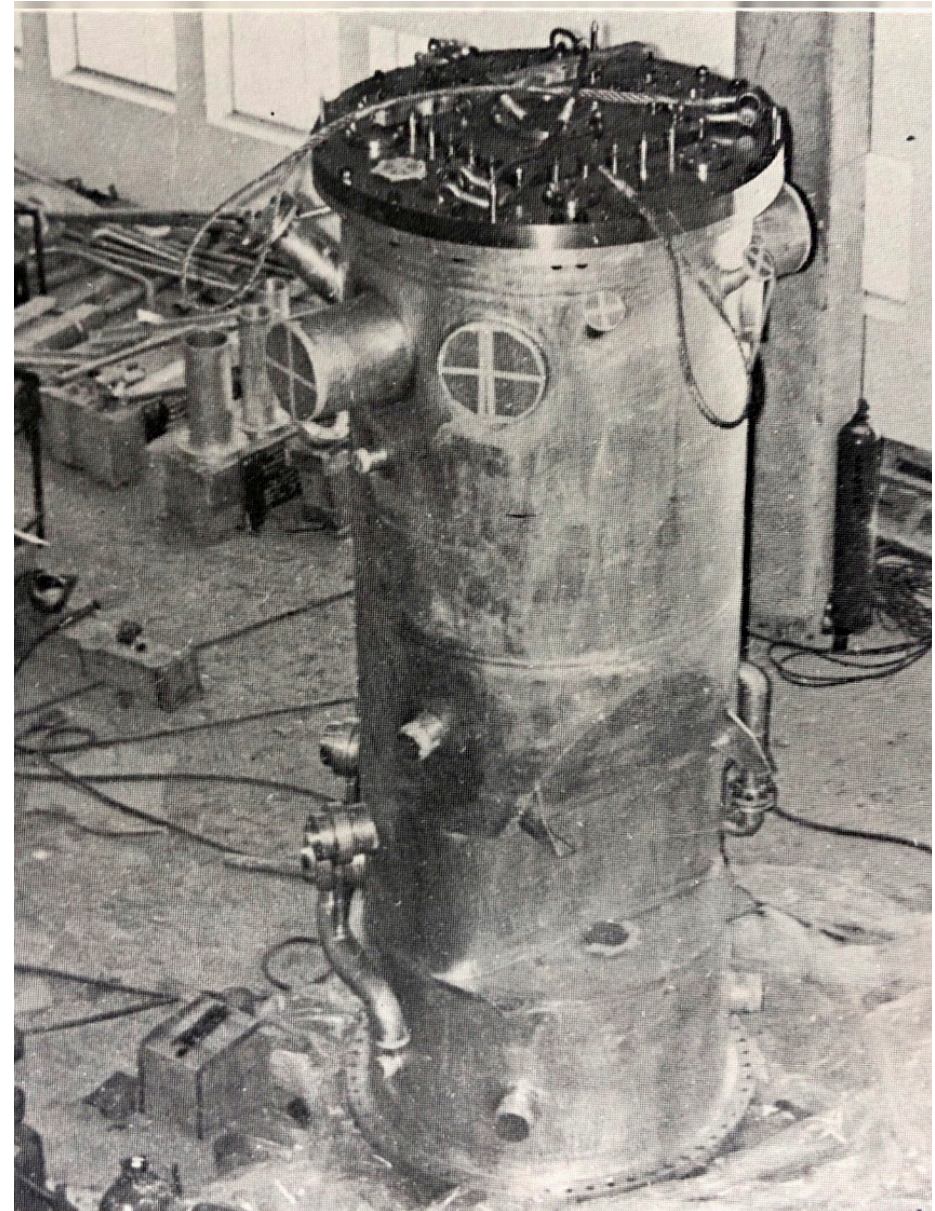


Figure 15: SAFARI-1 reactor prior to being installed (Newby-Fraser, 1979).

The exploration of nuclear explosives initially revolved around their potential civil applications, with several countries conducting research for mining and excavation purposes, including the US and USSR (Styen et al, 2003: 36). Therefore, limited research was conducted on nuclear weapons for potential civil applications. This marked an initial theoretical programme to lay the groundwork for peaceful nuclear explosives (PNEs). It should be noted that within the scientific world, PNEs differ incredibly from nuclear weapons. PNEs are designed for civil use in mining and construction, and nuclear weapons are designed to cause as much destruction as possible. The outcomes are entirely different. So even though South Africa started research into a nuclear bomb programme in the early 1970s, it did not actually produce anything during this time and, only after the decision to conduct nuclear weapons production, were the bombs made.

As mentioned earlier, the development of nuclear bombs requires extensive testing and experimentation. Therefore, alongside research into PNEs, the search for a suitable testing site commenced as early as 1973 (Styen et al, 2003: 39). The proposed site had to be sufficiently isolated, devoid of underground water sources, and possess deep underground rock formations to ensure a safe testing environment for such explosives (Styen et al, 2003: 39). The selected site, named Vastrap, is located in the Kalahari Desert.

By 1977, all preparations for conducting a dummy run at the Vastrap site were completed, although no actual nuclear weapons had been manufactured at this point. Instrumentation cables were being installed, and other necessary arrangements were underway (Styen et al, 2003: 39). However, on a Sunday in August 1977, an unmarked light aircraft flew over the site, eluding identification even after an investigation, as no flight plan had been scheduled (Styen et al, 2003: 40). Close to that time period, Russia informed the US about the possible test site, leading to tightened sanctions against South Africa through United Nations Security Council Resolution 418. The discovery of the test site also led to its abandonment.

Towards the end of 1978, Prime Minister P. W. Botha established a cabinet committee to oversee the commencement of nuclear weapon device development. This was then a move away from PNE research. The committee made the decision to immediately initiate a nuclear weapons programme specifically designed for military purposes (Styen et al, 2003: 42). Although the programme had previously been conducted covertly, it was now classified as Top Secret. While background research had been conducted, and facilities had been constructed for theoretical research, the decision to pursue the development of nuclear weapons rather than mere nuclear devices marked a significant turning point, thrusting the programme into full swing. Committee officials were tasked with determining the programme's scope and scale (Styen et al, 2003: 42).

The intricate process of designing and constructing the weapons unfolded across various sites. The majority of the programme's development took place at the Kentron Circle facility and the 5000 series buildings, both located in close proximity to Pelindaba. The 5000-buildings site, situated on the Pelindaba grounds (Figure 16), played a central role in uranium testing, explosives testing and machining (Albright and Stricker, 2016: 29). Given the uniqueness of the 5000-buildings site, its current condition of relatively forgotten structures and the fascinating experiments conducted there, it has been chosen as the site for this architectural thesis and will be elaborated on in further sections.



Figure 16: Pelindaba under construction, with the main housing for the SAFARI-1 reactor visible as built structure (NECSA, n.d.).

2.4 A NEUTRON FROM OUTER SPACE

Once South Africa had turned its PNE research programme for civil use into a nuclear weapons programme, it began to produce a nuclear bomb every few years until the closure of the programme, creating a total of seven devices. Due to the isolation of the country, the research for these weapons was practically built from the ground up, mimicking the invention of nuclear weapons in its conception, similar to the Los Alamos programme. The construction of these devices is surprisingly simple, yet has to be precisely calculated and manufactured. In order for a nuclear bomb to explode, the material within has to become 'supercritical' (Albright, 2018: online), and the methods at the time were essentially 'crude fission devices' using the manipulation of the mass of material within the bomb. The two ways of doing this are known as gun-type (Figure 17) and implosion design (Figure 18). South Africa chose to produce six completed gun-type devices and one incomplete device by the end of the 1980s.



Figure 17: A gun-type assembly at Los Alamos (AHF, 2017).



Figure 18: An implosion-type assembly at Los Alamos and later used in the first nuclear explosion, the Trinity Test (AHF, 2017).

The more complicated method is the implosion design. Essentially, this design works by taking the radioactive metal, plutonium or highly enriched uranium and violently compressing it down (Albright, 2018: online). The only way, at the time, to achieve this was to use high explosives, which makes the implosion design challenging to construct. Explosives must be arranged in such a way as to create a perfectly equal shock wave around the metal in order to compress it without shooting the sphere of metal out one side of the bomb (Albright, 2018: online) (Figure 19). These shaped charges that surround the core must all detonate simultaneously. Albright refers to this as an ‘art’ to figure out how to compress the material uniformly which produces shrinkage in diameter, which in turn causes an increase in density and makes the metal supercritical.

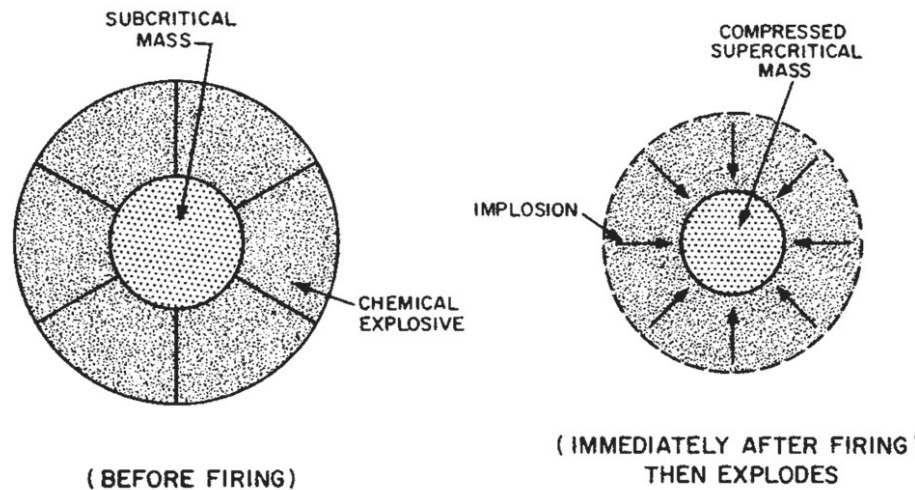


Figure 19: The compression of the the spherical core in the implosion design (Wellersein, 2012).

The gun-type design is more straightforward in its execution, which is why South Africa initially sought to produce these types of weapons. The concept of this method is to merely amass enough material to cause the metal to become supercritical. In essence, one part of the metal is placed at one end of the device and the other at the opposite end. When these two masses are forced together, a supercritical mass is made, and a nuclear explosion initiates (Albright, 2018: online) (Figure 20). Unlike the implosion device, which can be assembled from a variety of materials, for example, plutonium, HEU and others, a gun device is limited in the material that it can use. HEU is compatible with this method, and South Africa just happened to have a stockpile of it.

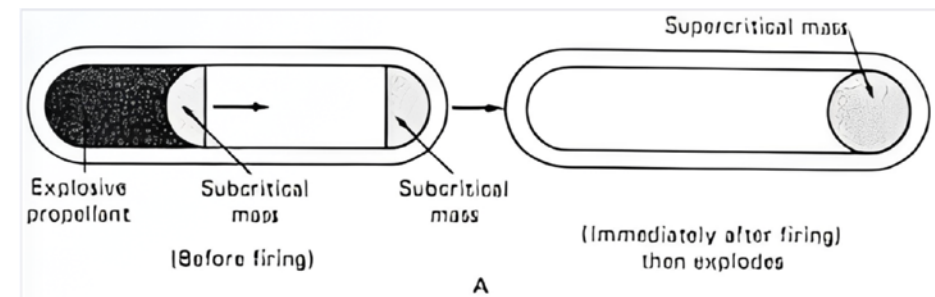


Figure 20: A gun-type assembly combining the two halves of the critical mass (Wellersein, 2012).

Robert Kelley (2020: 29), in his technical retrospective on South Africa's nuclear capability, describes the designations of the seven bombs South Africa created. The first bomb, made in 1979, was only completed as a test device. The following five were completed and weaponised, and the last was incomplete at the time of total programme dismantlement. Interestingly, the devices in the following table (Kelley, 2020: 29) exhibit a particular proclivity for incorporating biblical nomenclature.

Device Name:	HEU Enrichment:	Completion Date:
?	81.5	Dec. 1982
Feniks	90	Front: June 1986 Rear: June 1988
Maria	90	Front: Aug. 1987 Rear: June 1988
Ikabod	90	Front: Jan. 1988 Rear: July 1988
Skulla	90	Front: Nov. 1988 Rear: Mar. 1989
Abraham	90	Front: Mar. 1989 Rear: Mar. 1989
Menora	90	HEU machined, not completed

The dimensions allocated to the planned weapon, which takes the shape of a cylinder, were defined as 1.5 meters in length and 30 centimetres in diameter according to Kelley (2020: 32), but Albright (2018: online) talks about the South African design that was 1 meter in length and 60 centimetres in diameter. The nuclear apparatus was estimated to be approximately 430 kilograms in weight. To achieve the desired outcome of a weapon, a considerably thinner reflector than the one employed in the initial PNE design was envisioned by South Africa, with a higher anticipated yield (Kelley, 2020: 32).

To propel the projectile with a diameter of 90 millimetres, the gun barrel relied on roughly 350 grams of conventional gunpowder (Kelley, 2020: 32). The projectile assembly included a tungsten alloy nose at both the front and rear ends of the uranium component, serving to fulfil the functions of tamping and reflecting during the assembly process (Albright, 2018: online). These constituents, namely the HEU and the tungsten-copper tamper pieces, were securely held together within a steel shell (Kelley, 2020: 32). Essentially, the device operated by launching this 90-millimetre projectile down a 'naval gun barrel' (Albright, 2018: online) that would be caught in place inside the HEU sphere, thus completing the mass for criticality and causing the bomb to go supercritical.

The supercritical chain reaction happens when the two parts of HEU reach a suitable mass, as stated previously. The reaction works when the HEU sphere is enclosed in a reflector; the HEU emits neutrons that bounce off the reflector back into the mass, causing more neutrons to be emitted, resulting in an exponential chain reaction going supercritical. Often nuclear devices will be designed with a neutron initiator (to start the reaction), but in the South African example, a neutron travelling from outer space will trigger the chain reaction (Albright, 2018: online). This happens in a matter of milliseconds.

It is worth noting that the core design did not incorporate bolts, pins, or step joints, thereby rendering the alignment of the approximately 13 components within the steel shell a challenging task. Alignment was paramount, as the spherical cavity needed to be straight and accurately centred upon the projectile's arrival after its discharge down the barrel. To address this predicament, the

front-end core was carefully assembled by hand. The weaponised device was projected to yield an approximate range of 14 to 19 kilotons (Kelley, 2020: 33).

The testing of nuclear weapons is a fundamental part of the development cycle, and not doing any tests would limit the future capabilities of atomic weapons that a state seeks to produce. However, a nuclear bomb test is a massive undertaking. Since South Africa's proposed testing site, Vastrap, had already been exposed, other means were undertaken to test the potential of South Africa's bombs. Such tests are referred to as criticality tests, also known as 'tickling the dragon's tail'.

2.5 TIMELINE

While the actions of the nuclear programme are incredibly complicated and cannot be fully elaborated here, the explanations fleshed out in the previous sections are meant to give the reader a broad understanding of the incidents that led up to and comprised the nuclear programme. On the following page, a timeline from 1966 to 2002 details a few of the major events that took place relating to the war in Angola as well as the nuclear programme. Some events in the timeline have not been fully explained in the previous sections but have been included to provide a fuller context. The battles within Angola are only mentioned by name in the timeline, some by the SADF operation designation.

The chosen timeline starts and ends with the major conflicts inside Angola, from the beginning of stirrings within the country to the end of the civil war. The time period also sees the end of colonial rule in Namibia, which had been a long drawn-out struggle since the beginning of the German occupation in the early 1884 and lasted until 1915 when South Africa, allied with the British in World War 1, captured the territory from German control (SAHO, 2011: online). The war in Angola is termed the 'Border War' as well as the 'Namibian War of Independence' as well as other names depending on whom one asks. The point is that war is experienced differently via the different perspectives of history. Any omission of events in this timeline is not due to a lack of care of these events, but rather to give an understanding that relates strictly to the nuclear weapons programme, as this is where the emphasis lies in this thesis.

Information compiled in this timeline is obtained from a variety of sources, namely (SAHO, 2011: online), (Baekmann et al., 1995), (Albright and Stricker, 2016), (Scholtz, 2020) including deductions made during the research into the programme.

SADF Operation Blouwildebrees to counter PLAN, the armed wing of SWAPO, in northern SWA.

RSA Civil Defence Amendment Act of 1967 mandating conscription in SA.

1966

1967

1968

1969

1970

1971

1972

1973

1974

1975

1976

1977

1978

1979

1980

1981

1982

1983

1984

Uranium enrichment project initiated.

Approval for PNE programme.

Investigation into the separation of lithium isotopes.

Kalahari test site (Vastrap) approved for development. First stage of HEU enrichment plant commenced.

Vastrap construction commenced.

USA stops imports of HEU for SAFARI-1.

Vastrap abandoned due to discovery from USSR.

Cabinet decision to start programme for nuclear weapons development.

First HEU metal produced from enrichment plant.

Criticality test for HEU in Building 5000 (tickling the dragon's tail).

First nuclear device completed in Building 5200.

Construction of tritium laboratory.

Approval to research plutonium production devices. Kentron Circle facility constructed.

Second nuclear device completed.

Portuguese overthrown through coup.

Angola gains official independence, MPLA takes control.

SADF Operation Savannah support FNLA and UNITA.

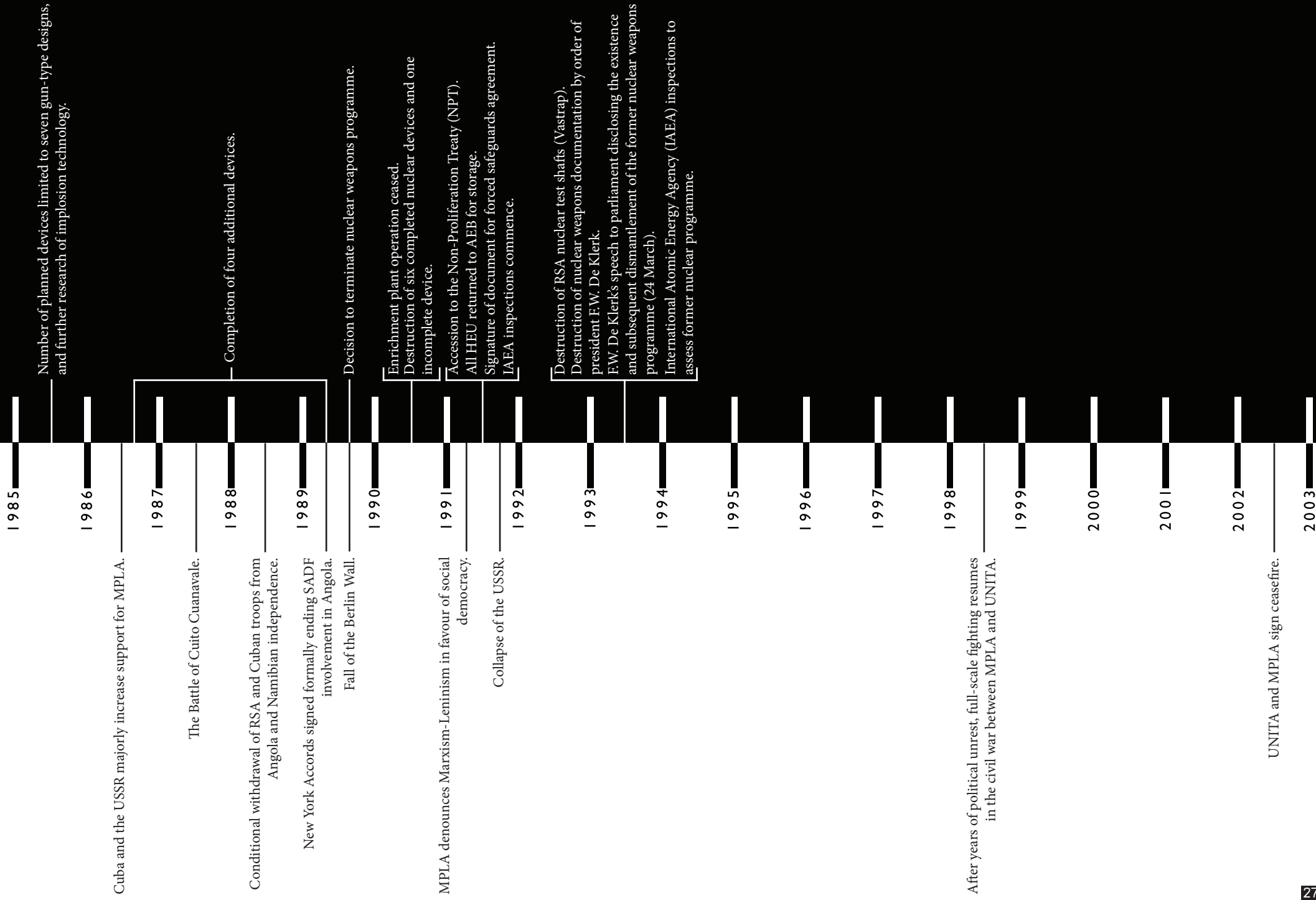
USSR presence increases support for MPLA through equipment, weapons and military advisors.

Cuba lands troops, conducts military and advises the MPLA government in Angola.

RSA withdraw due to a lack of support from the US. FNLA and UNITA withdraw to the bush.

MPLA firmly establishes itself as Marxist-Leninist. United Nations Security Council Resolution 418.

RSA launches Operation Sceptic, offensive against SWAPO in Angola



2.6 MACRO ENVIRONMENT

When trying to analyse the broad impact of the programme (Figure 21) and what is left of it today, the main sites — although far apart in some cases — are important to focus on as the secret actions within these structures influenced one another. For the purpose of this document, three main sites are looked at in the macro analysis: the Vastrap testing site in the Kalahari (Figure 22), the Pelindaba site near Hartbeespoort Dam (Figure 23) and the nearby Kentron facility (Figure 23). The majority of the programme was established in and around the Pelindaba site and then spread to the other locations. Initially, the PNE programme started at the secret site at Pelindaba, later the Vastrap explosions test site was drilled and once the PNE programme was changed for weapons development, the Kentron facility was utilised.

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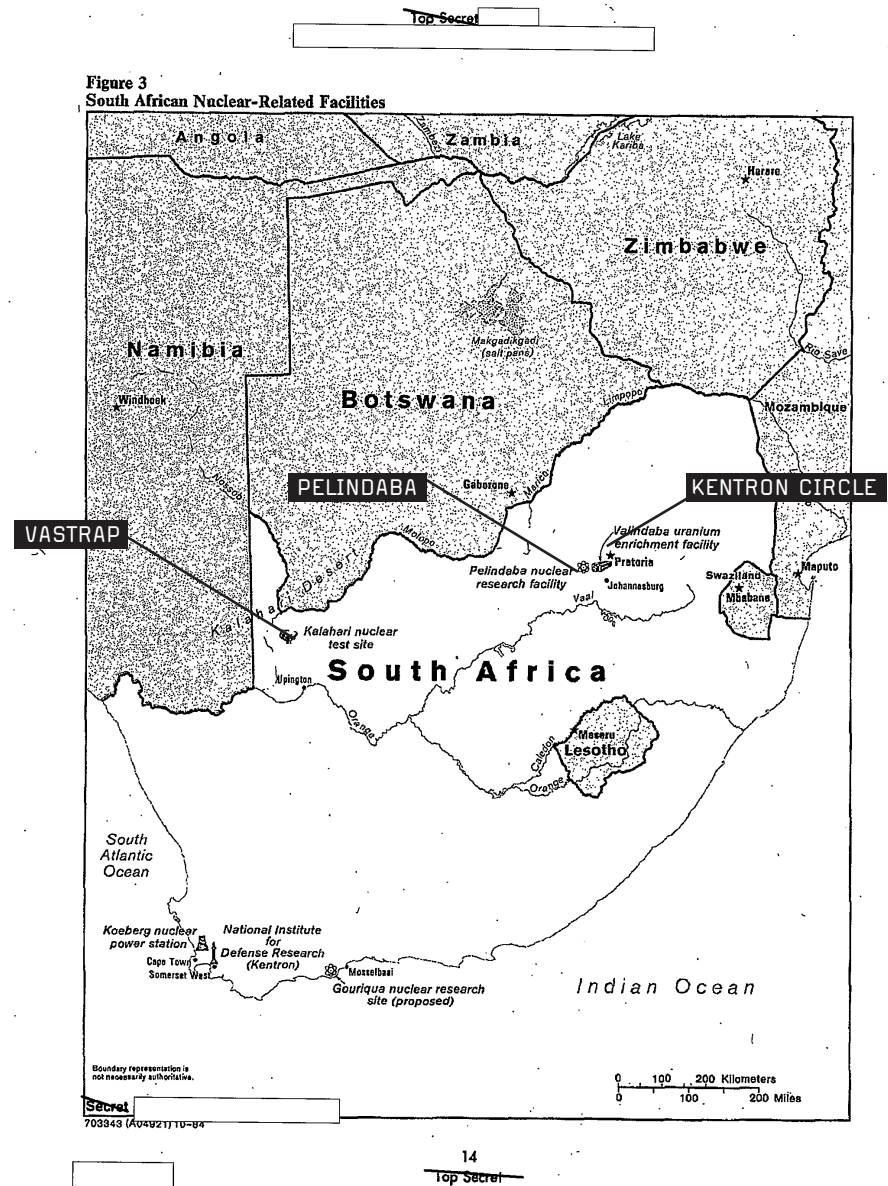


Figure 21: The nuclear programme across South Africa (CIA, 1984).

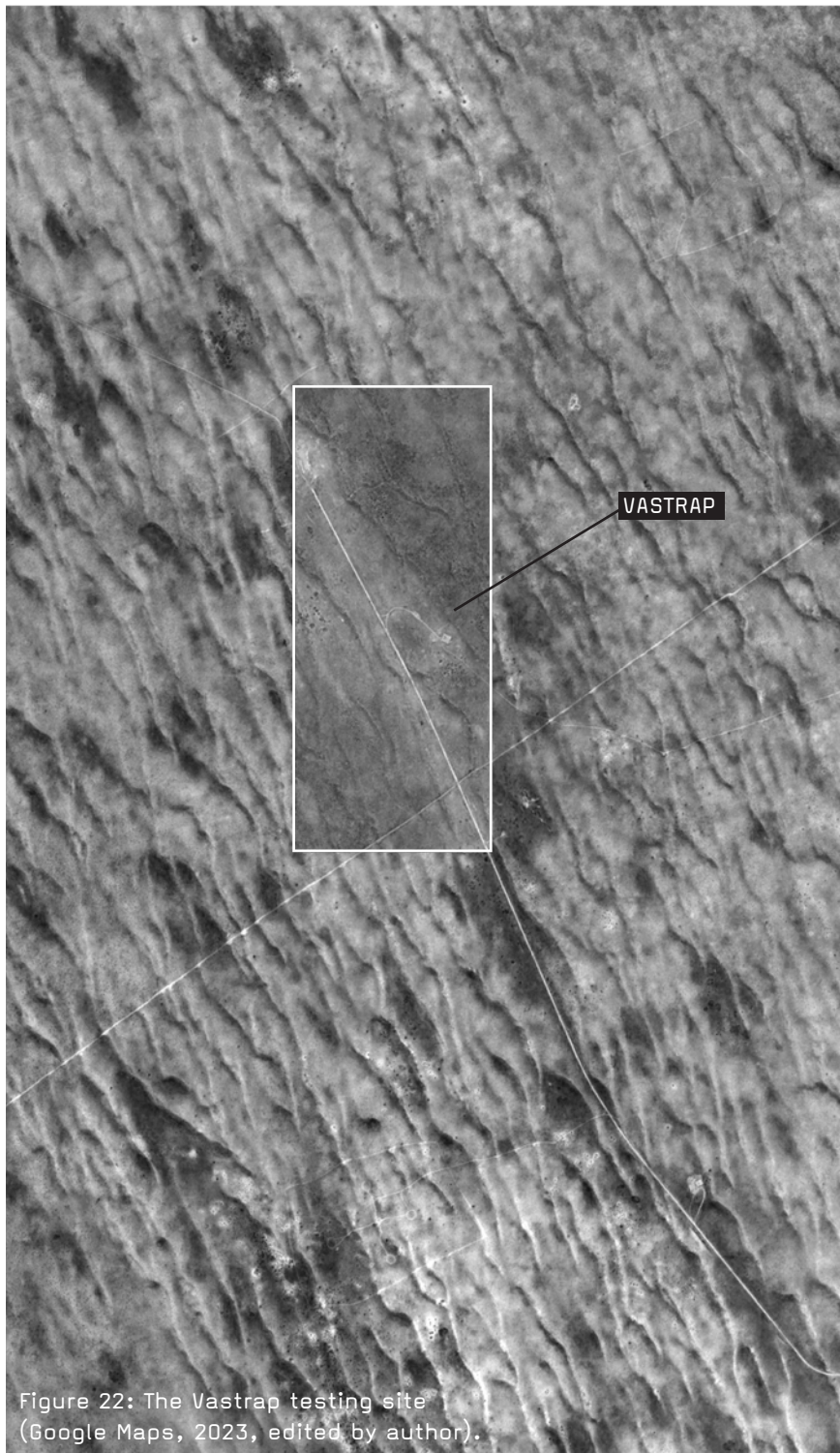


Figure 22: The Vastrap testing site (Google Maps, 2023, edited by author).

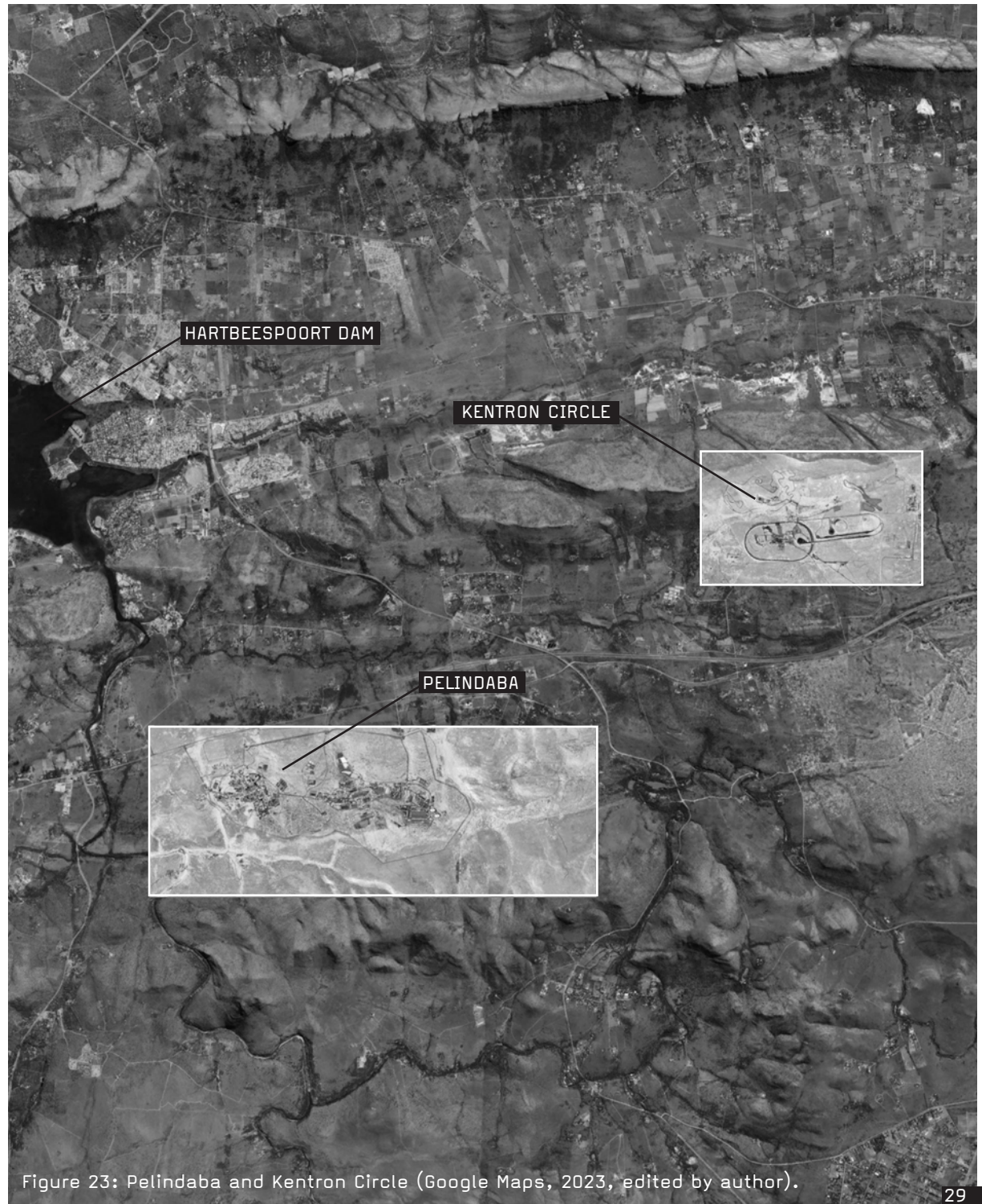


Figure 23: Pelindaba and Kentron Circle (Google Maps, 2023, edited by author).

2.6.1 VASTRAP

After South Africa had surveyed areas for a nuclear test, the decision to construct such a site in the Kalahari, 70km north of Upington, was taken as early as 1974 (Albright et al, 2011). The Vastrap site (-27.765334, 21.468352) was meant to test underground nuclear explosions down vertical test shafts, with two shafts being drilled, the first 385 meters deep and the second 216 meters (Albright et al, 2011) (Figure 24). Secret measures were taken in order to hide the site from satellite surveillance. Still, the site was discovered by the Soviets in 1977, as detailed previously. While the world thought that by the discovery, South Africa had indeed built a nuclear bomb and was preparing to test one, they had not actually produced any yet and the site was only meant for a 'cold' test. The site was kept on standby until 1989 when the shafts were sealed, and later in 1993 they were filled completely with sand and concrete.

As part of the secrecy of the site, several methods were employed to mislead satellite imagery. The site was built next to other Armscor military testing facilities, presumably to distract from odd activity involving Atomic Energy Board facilities in unexplained locations. Decoy military equipment was also placed near the site to make it look like normal military testing, such as dummy tanks and vehicles. This deployment of physical decoys is a fascinating realisation of the front South Africa was playing at the time. The facade of information was just as present on the site in physical terms as it was in words by those in power. Although it did much to confuse the world, it was still known that some dark deeds were afoot behind closed doors.

In 1987 there was a great expectation by the government that the site would be used for the testing of a weapon, and Armscor inspected the site to make sure that it could be used for this purpose (Albright et al, 2011). As part of the preparation, a steel and corrugated sheeting hanger on a concrete footing was constructed over the first shaft, it was called 'The Shade' (Albright and Stricker, 2016: 227) (Figure 25).

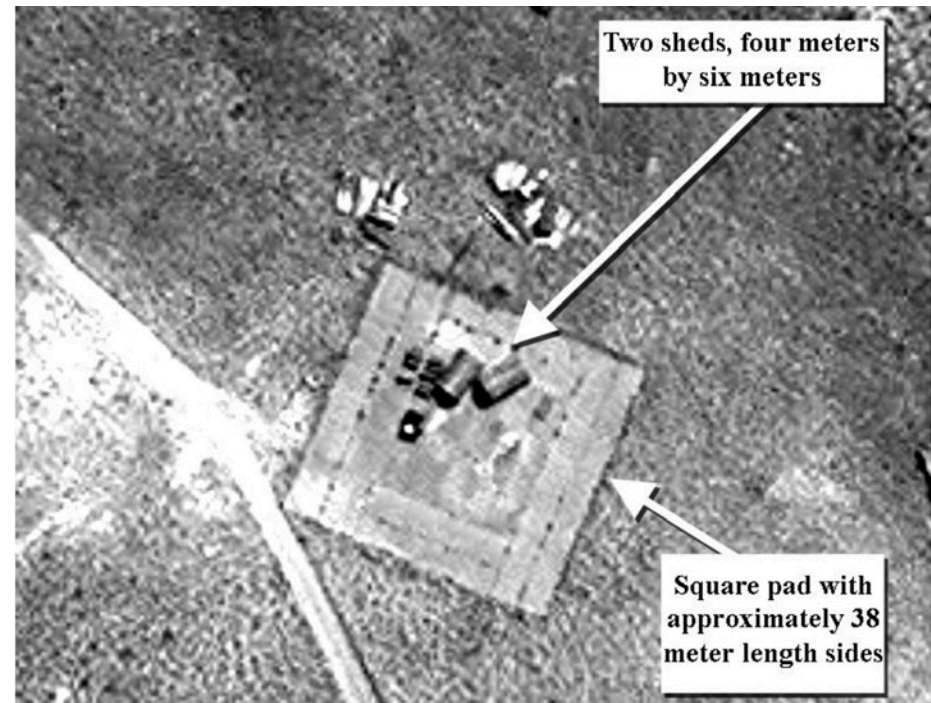


Figure 24: First Test shaft from above (Albright et al, 2011).



Figure 25: 'The Shade' (Albright et al, 2011).



Figure 26: Shaft 2, before reopening (ISIS, 2018).



Figure 27: Shaft 1 opened, 385 meters deep (ISIS, 2018).

The purpose of this 'Shade' was to obscure the doings and testing if it were to occur at the first test shaft. This type of simple and unassuming structure is indicative of the programme. Interestingly, it shares similarities with the other buildings in the programme, specifically the buildings that are later used in this document as part of the proposed design.

When the entire nuclear programme was dismantled, one of the steps was to fully nullify the Vastrap testing shafts (Albright and Stricker, 2016: 247), which involved filling them with sand and periodic concrete plugs to prevent the holes from being redrilled. A video of this exists online. The video (ISIS, 2018: online) shows how the test shaft 'concrete caps' were opened using a combination of jack-hammers, bulldozers and explosives (Figure 26). Once opened (Figure 27), the shafts were pumped free of water and then, incrementally, sand was poured in, followed by concrete plugs. All this was done to ensure that they could never be used in the future.

2.6.2 KENTRON CIRCLE

Once the decision was taken to turn the PNE programme into a nuclear weapons programme, Armscor became very involved in the testing and production of the weapons. A dedicated facility for the creation of nuclear weapons was built at the Kentron Circle facility (-25.752409, 28.004957) on Armscor ground in 1981, 15 kilometres east of Pelindaba (Figures 28 and 29). A private governmental speech by then Prime minister P.W. Botha stated, “The time has come when the South African [‘ploughshare’] must be forged into a sword, for the battle that awaits” (Albright and Stricker, 2016: 90). This contorted reversal of the biblical text became a statement that was (ironically) performed in reverse at the end of the programme.

The facility was the site of much weapons testing and explosives manufacturing for the bombs. It also housed a specially designed vault to securely store nuclear weapons (Albright and Stricker, 2016: 90). Botha also linked the happenings of the Circle facility and the nuclear programme to the Los Alamos programme in America (Albright and Stricker, 2016: 91). The link is likely seen through the secrecy involved in both programmes and similar discoveries of nuclear science. South Africa essentially reinvented the bomb from inside the country due to the political situation of isolation.

Access to the inside of the facility was prevented when attempts to make contact and visit the site for this research were made. Due to the site being part of Armscor to this day and it being a base for vehicle testing and development, it is no surprise that it is a restricted site. In an interview with Vincent Bezuidenhout, an artist who has done an exhibition on the South African nuclear programme, he said in reference to trying to access the Kentron facility (Bezuidenhout, 2023), “...at the time, the person in charge of their PR [for Armscor] used to work at the SAFARI-1 reactor during apartheid, and he definitely didn’t want me snooping around. And there were threats made, so I had to go.” It seems as though the secrecy of this site still haunts the place to this day.

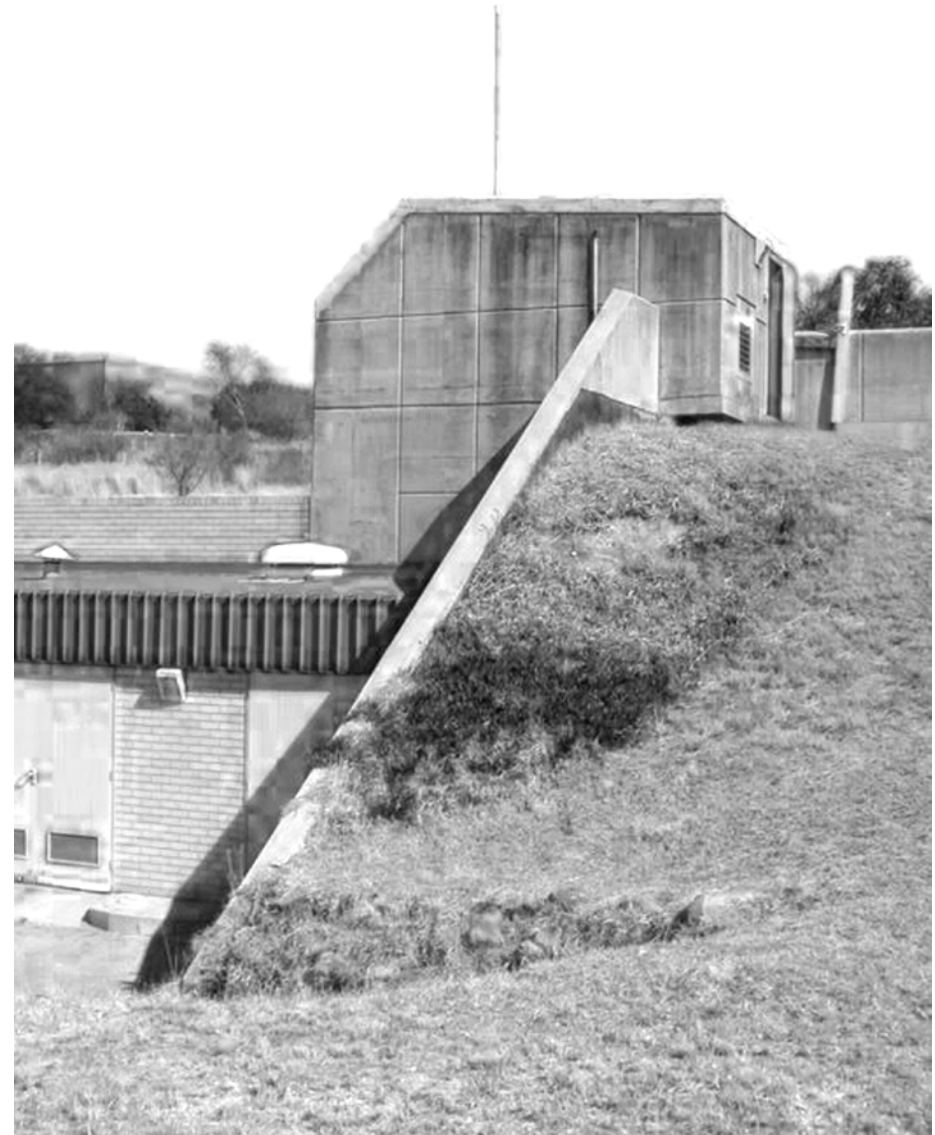


Figure 28: Underground building at the Kentron Circle facility (Albright and Stricker, 2016).



Figure 29: Hidden in the hills (Albright and Stricker, 2016).



Figure 30: The vaults (Albright and Stricker, 2016).

However, a fascinating relationship exists with regard to the nuclear sites and film media. The well-known film, *District 9* (2009), directed by Neill Blomkamp, features scenes of the movie shot inside the Kentron Circle facility, clearly showing the vault doors (Figure 30) to the secure storage in the backdrop. If this was intentional or even known by the filmmakers is an interesting conversation on its own. The fact that remnants of South Africa's nuclear programme have appeared in public media without most people's knowledge is reflective just of how the programme existed in plain sight but was completely secret, the apparition of historical ghosts still showing themselves in contemporary media.

2.6.3 PELINDABA

The Pelindaba site (-25.798726, 27.919533) (Figure 31) was constructed in 1960 by the Atomic Energy Board on the farmland of Gustav Preller, an Afrikaans Historian, in 1960 (Albright and Stricker, 2016: 4). Today, it is run by NECSA. It is classified as a National Key Point, meaning they do not take kindly to students asking questions about a long-abandoned nuclear weapons programme (Figure 32).

That fascinating relationship between the nuclear sites and media comes back again here. Like the Kentron Circle facility, the landscape in Pelindaba has been used for filming. The atomic site in the valley and the Crocodile River feature in a movie titled *Rogue* (2020), directed by M. J. Bassett. The nuclear buildings are seen in only a few frames in the distance, but their ghost-like appearance reveals how the site is alluring yet unknown. Likely, the director did not even know the building's previous function, as it seems almost an accident that they were included in the filming.

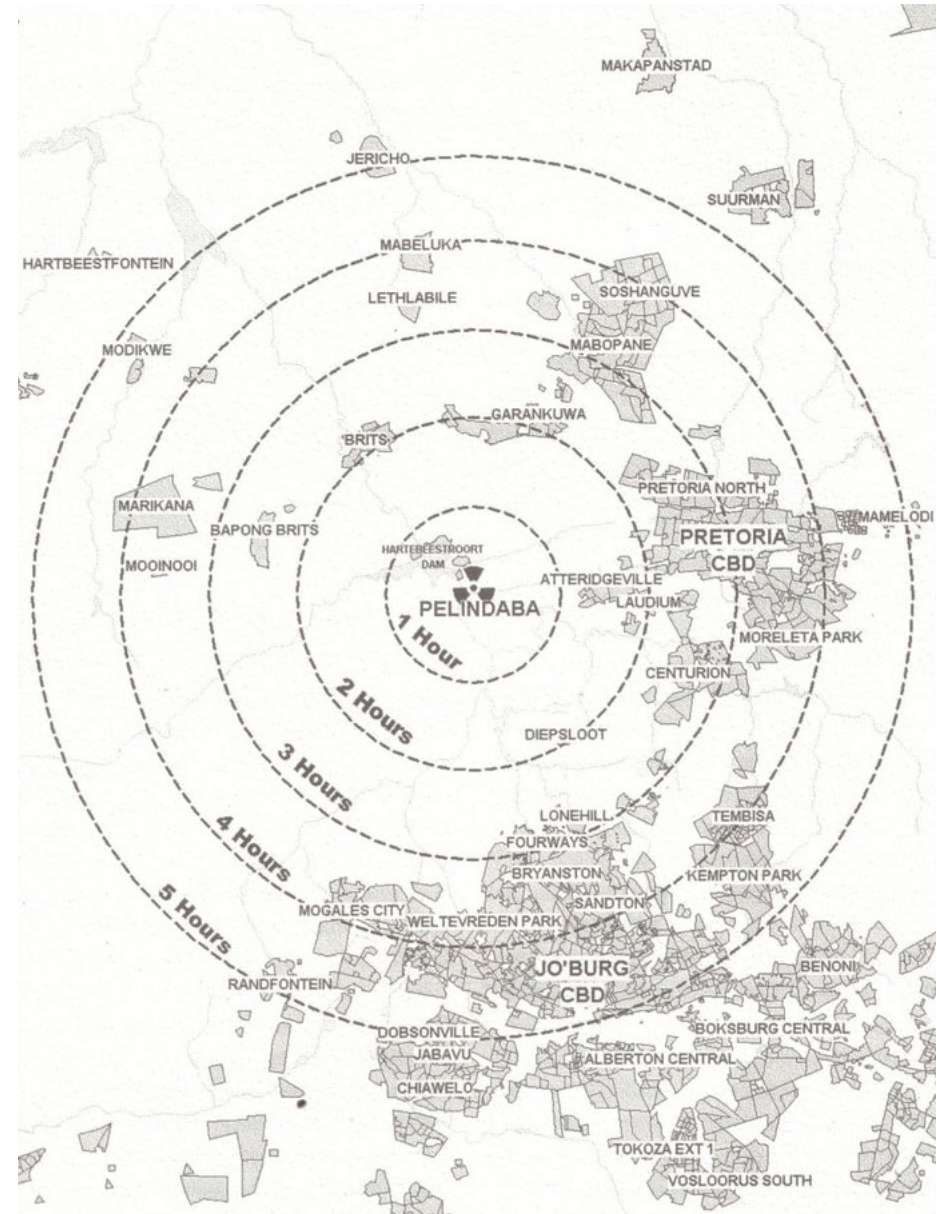


Figure 31: Pelindaba and its reach (NECSA, n.d.).



Figure 32: Even while walking in the natural surroundings one can hear the hum and hiss of the industrial site (author, 2023).

2.7 MEZZO ENVIRONMENT

The mezzo environment takes a closer look at the happenings of Pelindaba today (Figure 33). The land encompasses a large area in the middle of which the main security fence sits, containing many nuclear research buildings. There are a few other goings-on on the site besides the main facility (Figure 34): the Preller family house is still located on the land and is considered a national heritage site, the Crocodile River runs along the edge of the site where NECSA has set up a pump house, and the nuclear weapons buildings in the valley below are not utilised by NECSA but rented by separate company, which remains undisclosed in this document.

Due to the interesting circumstances under which the land was originally obtained by the AEB, there are quite a few activities that one would not expect on the site. Not everything can be analysed, but a few of the facilities include: a hiking trail circling the Preller farmhouse that overlooks the 5000 Building series, a public campsite less than a kilometre from the 5000 Building series ('temporarily' closed as of this writing), canoeing activities that travel right past the site on the Crocodile River and a rock-climbing location on some of the cliffs next to the Crocodile River. Even though Pelindaba is classified as a National Key Point, the site makes its own way through the industry upon it.



Figure 33: Looming industry over neglected Preller graveyard (author, 2023).



Figure 34: Map of Pelindaba (Google maps, 2023, edited by author).

2.7.1 NECSA

Some of the notable structures in the area are as follows (Figures 35 and 36):

- **5000 Building series:** Building 5000, 5100, 5200, 5300 and the magazine.
- **Campsite:** Operated by those managing the restaurant at the Preller house.
- **Crocodile River:** The river that feeds into Hartbeespoort Dam.
- **NECSA security fence:** Highly monitored fence that portions off the main facilities run by NECSA.
- **Preller farmhouse:** The old farmhouse now turned into a restaurant.
- **Preller graveyard:** Where members of the Preller family are buried.
- **Pump house:** Pump house provides water for the SAFARI-1 reactor.
- **SAFARI-1 building:** The building housing the reactor.

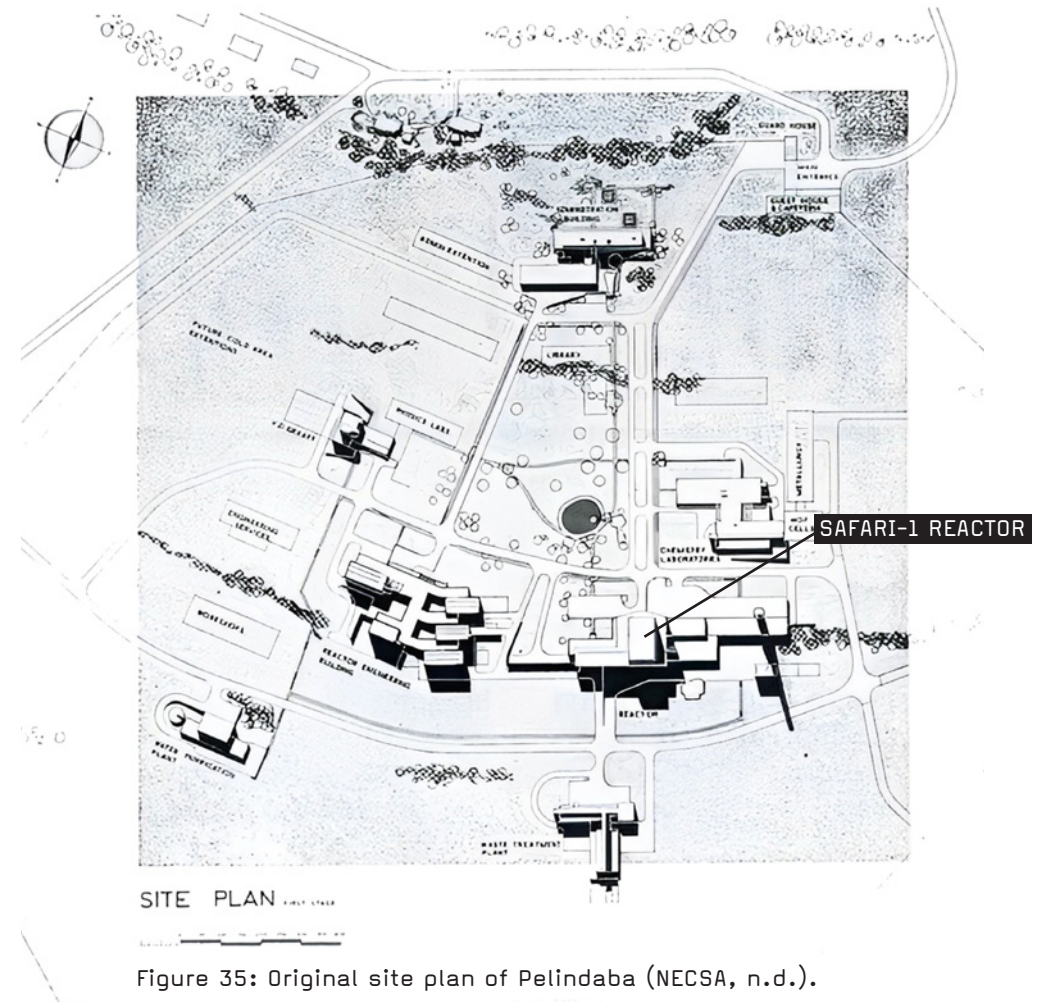


Figure 35: Original site plan of Pelindaba (NECSA, n.d.).

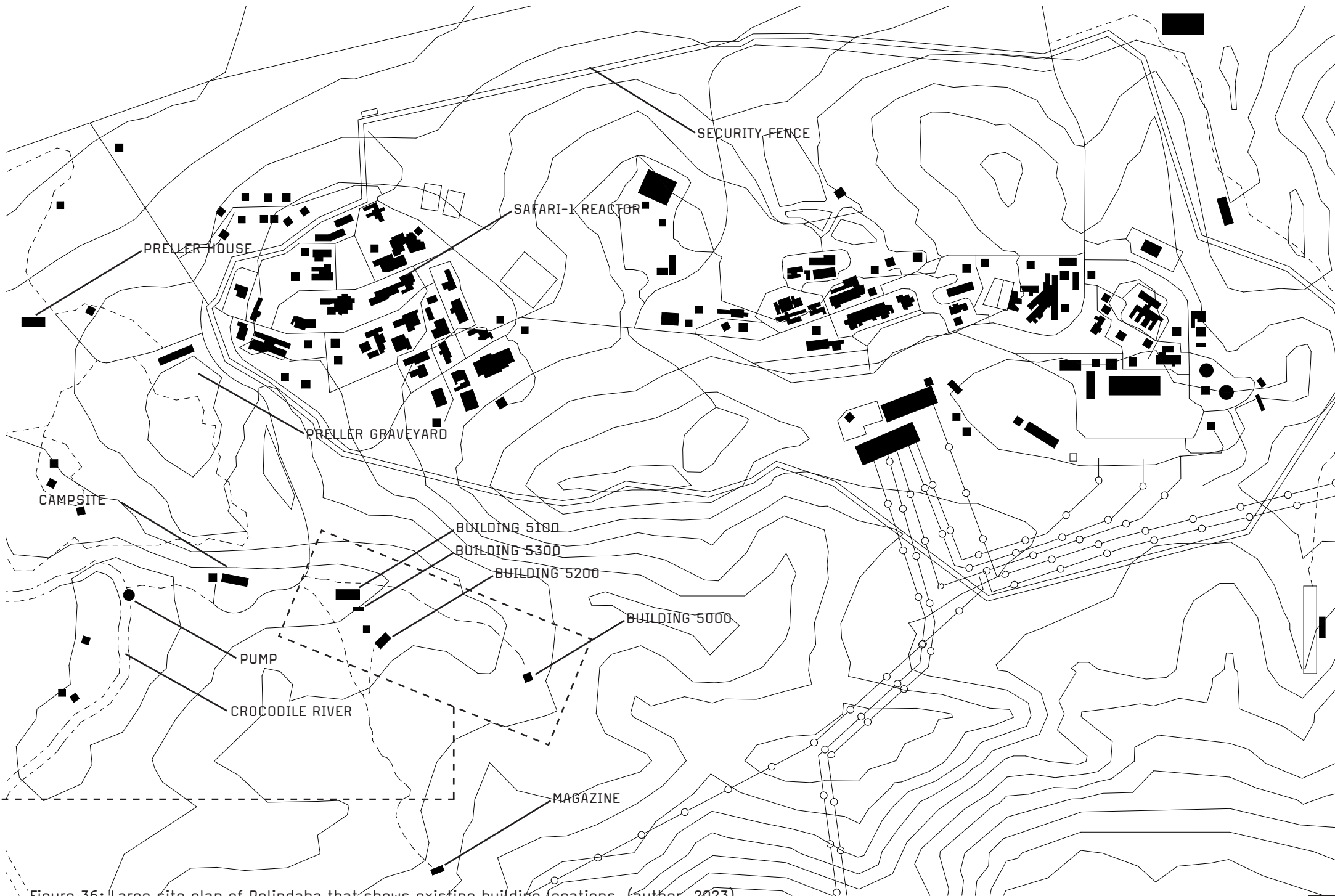


Figure 36: Large site plan of Pelindaba that shows existing building locations (author, 2023).

2.7.2 PRELLER FARM

The land on which Pelindaba was built originally belonged to Gustav Preller and his family. Gustav Preller, a prominent journalist and historian renowned for his advocacy of the Afrikaans language, resided in this house from 1935 until his passing (Gustav Preller Huis, 2011). In recognition of its historical significance, the house was designated a National Monument under the old NMC legislation on March 2, 1973 (Gustav Preller Huis, 2011) (Figure 37). Simultaneously, as part of a distinct Government Notice, three stone rondavels, constructed by Preller in Pelindaba in 1920 and originally utilized as a weekend retreat by the family (Figure 38), were also accorded the status of National Monuments. Gustav Preller's legacy's historical and cultural importance and the architectural elements are very much associated with the history of the place.

Gustav Preller died on 6 October 1943 and was buried in the family graveyard. The graveyard is located near the house on a hill overlooking the valley and is ominously watched by the industrial buildings at Pelindaba. The graveyard, as well as the house, are constructed from the local slate rock (Figures 39 and 40), adding to the historical importance of it.

The house is used as a restaurant and starting point for local hikers today. The family seems to run things from afar and additionally manages the campsite in the valley. In a handmade document found inside the house, the family details how the land was acquired by NECSA:

“In 1959 the Government asked for an option to buy the farm. It was refused.

In 1960 the Genootskap van Oud Pretoria said that “*geen inbreuk gemaak mag word op plekke van historiese betekenis.*”

In 1969 the Departement Landboukrediet en Grondbesit requested an “*uiters dringende aankoop*” of the farm. A letter stating “*indien u klient nie bereid is om die grond te verkoop nie sal die Departement ongelukkig geen keuse gelaat word, dan om tot die onteining daaraan oor te gaan nie.*”

Dr Roux of the Atomic Energy Board met with the owners in 1969 who said there would be no expropriation but that a sale would be negotiated. Roux promised that the family graveyard would be respected.”



Figure 37: Rear courtyard of the Preller house (author, 2023).

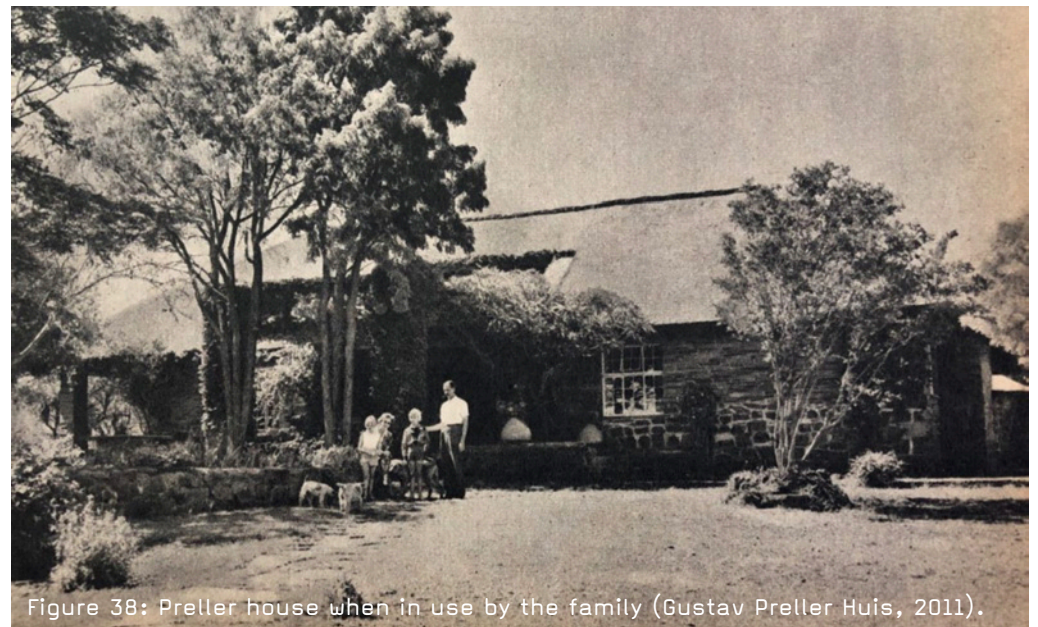


Figure 38: Preller house when in use by the family (Gustav Preller Huis, 2011).

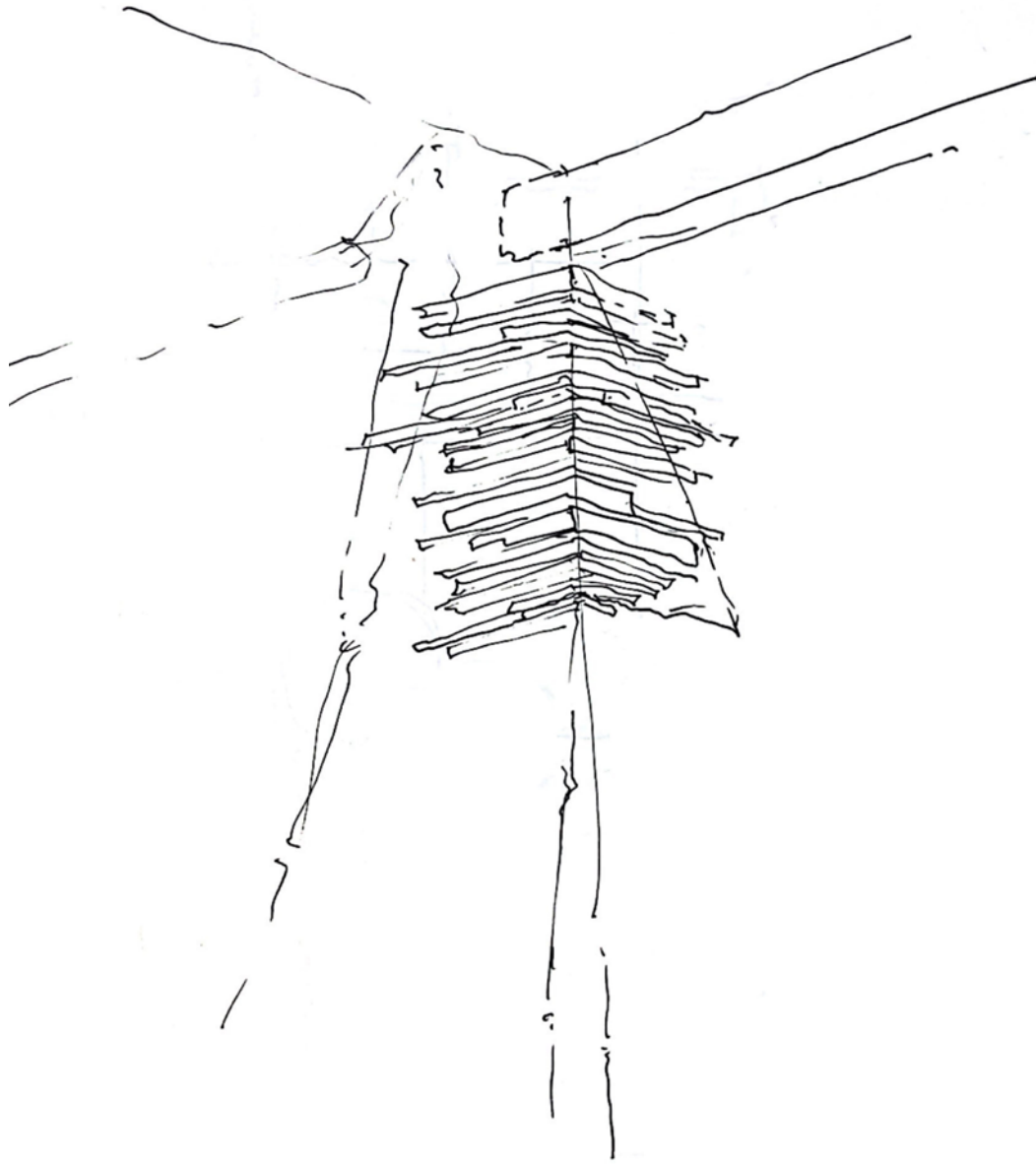


Figure 39: Slate walls and light (author, 2023).

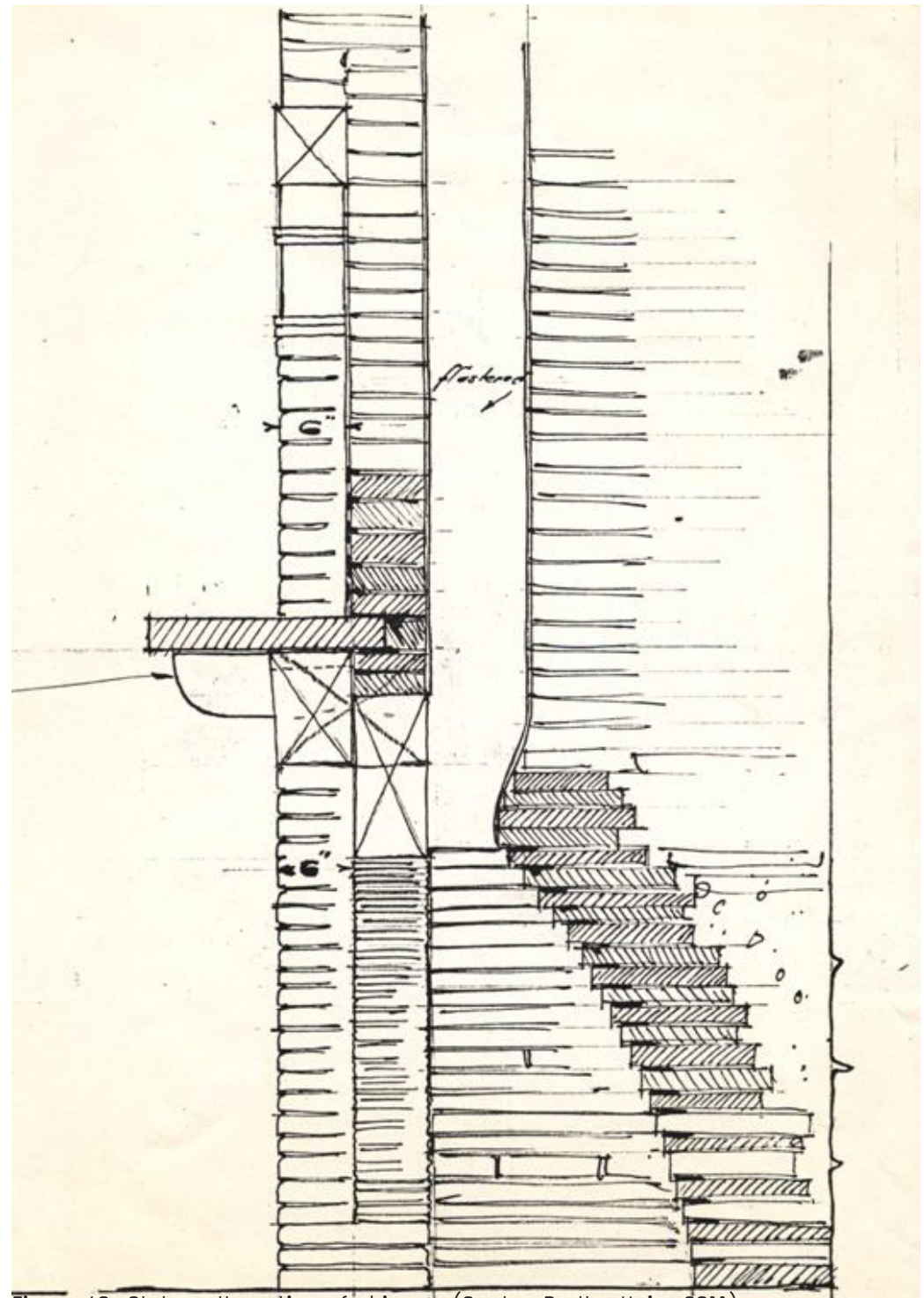


Figure 40: Slate wall section of chimney. (Gustav Preller Huis, 2011).

2.7.3 SAFARI-1 REACTOR

The construction of the SAFARI-1 reactor was a collaborative effort facilitated by the U.S. Department of Energy during the 1950s and '60s. Initially, the reactor operated with high enriched uranium (HEU) fuel, which was sourced from the United States (Styen et al, 2003: 34). However, in 1975, in response to South Africa's nuclear weapons programme and the establishment of the Valindaba Y-plant (the area inside Pelindaba that manufactured HEU), the United States suspended its export of HEU to South Africa as a form of protest.

The reactor is housed in one of the main buildings inside the restricted walls of Pelindaba. Difficult to come by drawings such as these allow for a better understanding of the 'nuclear tectonics' of the site (Figure 41-43).

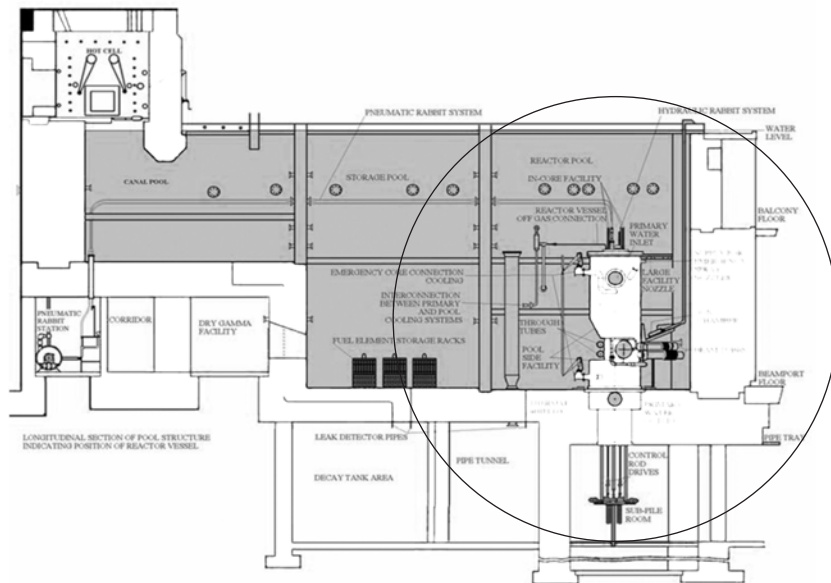


Figure 41: The reactor bath (RR-SSPE-0046, 2020).

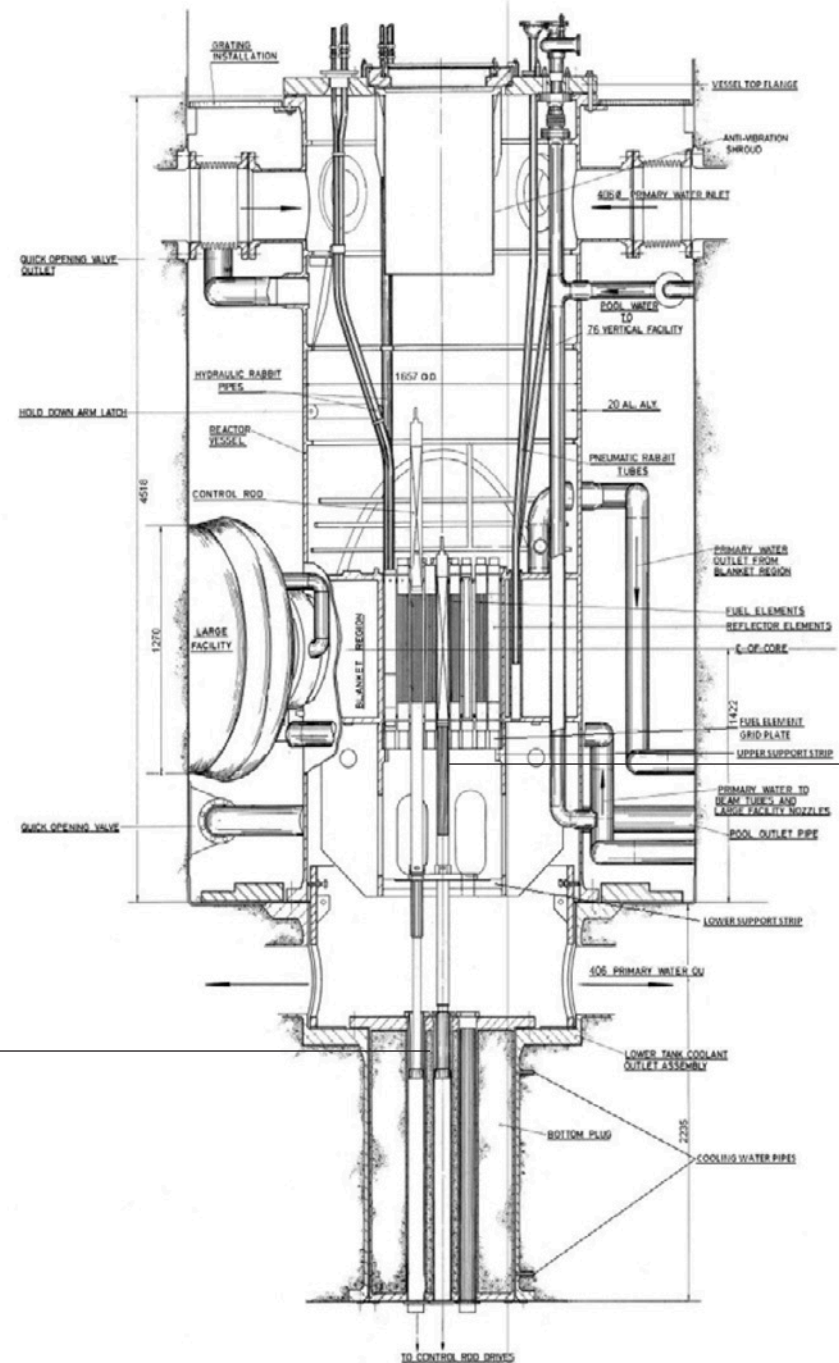


Figure 42: The reactor (RR-SSPE-0046, 2020).

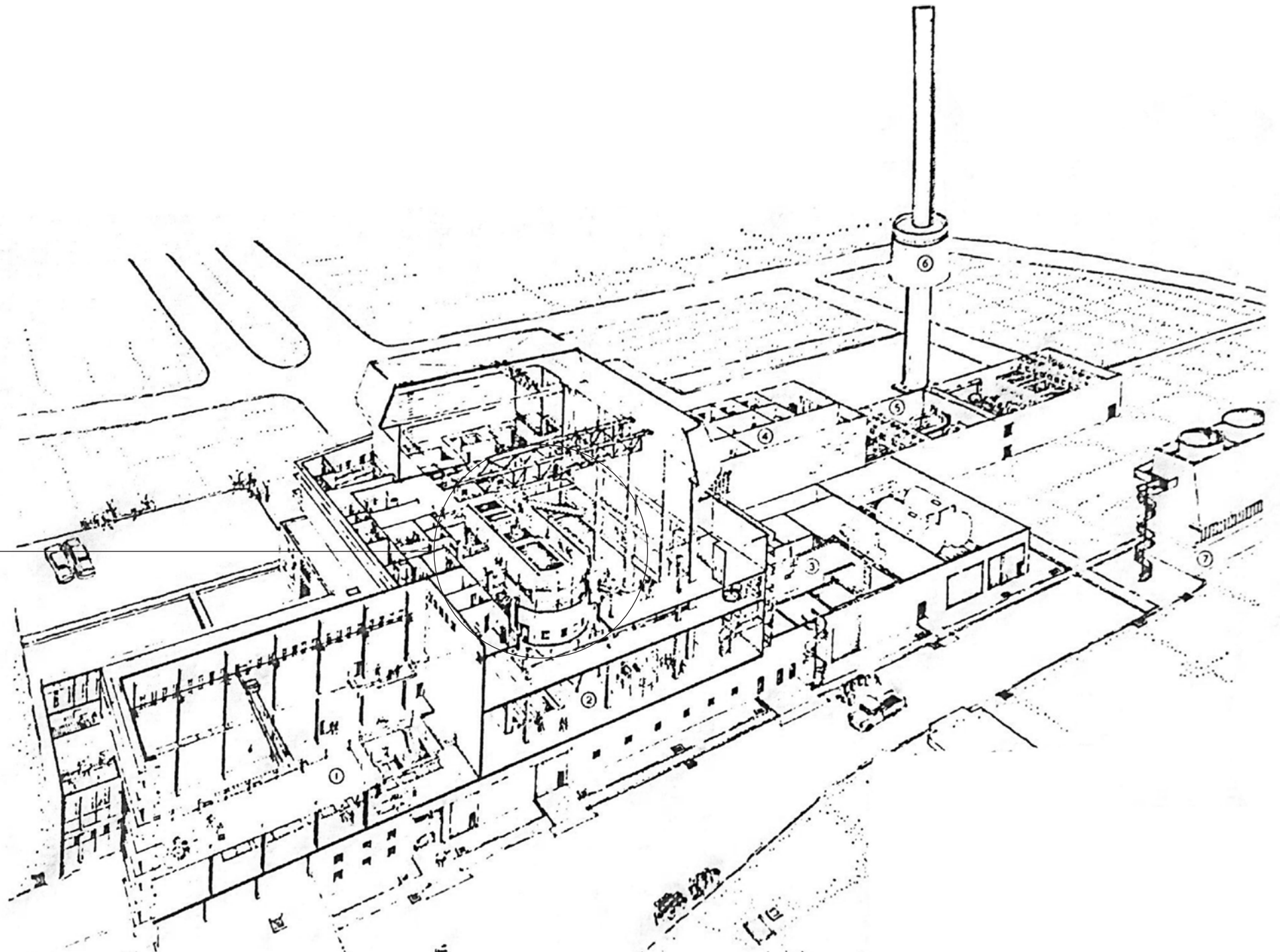


Figure 43: The reactor bath and building layout visible in axonometric drawing (Cerwenka and Rogres, 1978).

2.8 MICRO ENVIRONMENT

On the micro level, the site is composed of four main buildings (Figures 44 and 45) that were used in the research and construction of the nuclear bomb (Albright and Stricker, 2016: 38).

Building 5000: This facility contained a pulse reactor used for testing computer models. In 1979 it played a crucial role in an experiment confirming the gun-type device's design. It was later closed in the early 1980s.

Building 5100: This building housed the control room for Building 5000, offices, labs, and equipment for working with uranium. At its peak about 100 people worked here. As of the end of 2019 it has stood in partial demolition.

Building 5200: This building held a large two-stage light gas gun. Those working here conducted experiments with HEU to verify nuclear explosive device components and saw assembly of the first device in 1979. It also stored vehicles and cabling for potential tests at the Kalahari test site

Building 5300: This facility was exclusively a high explosives laboratory, initially producing small quantities by pressing and machining during the early South African nuclear programme.



Figure 44: Building 5000 and 5100 and the line through vegetation (author, 2023).

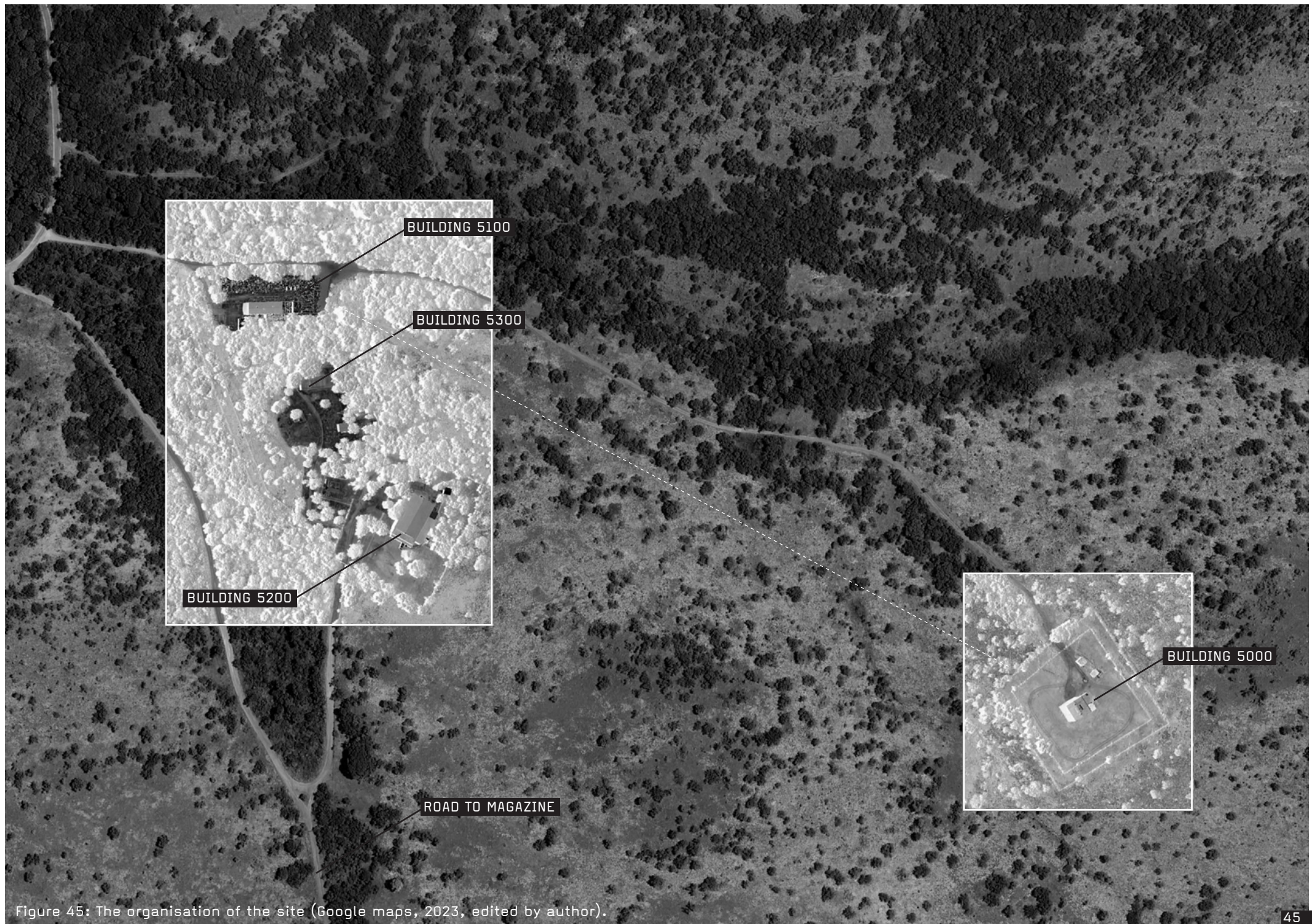


Figure 45: The organisation of the site (Google maps, 2023, edited by author).

One of the most crucial relationships between these buildings, that brings about considerable design guidance, is the control line between Building 5000 and Building 5100. 'The line' is the cable that spans underground between the reactor (5000) and the control room for that reactor (5100). Due to the highly dangerous experimentation of the reactor, all personnel would vacate Building 5000 during a test. Today, the control line is still visible by a cut through the natural vegetation on site.

The line is the vital artery joining the two structures. Essentially, the two buildings can be thought of as one, only that there needed to be a separation of the test reactor from human beings. The hill between the two structures acts as a barrier to harmful radiation in the case of an accident.

It should be noted that these two buildings appear to be the most significant in the programme (Figures 47 and 48). They hold so much importance, even now in their ghostly remains, because of the experimentation that they once held. The line that connects Building 5000 (the reactor) and Building 5100 (the control room) is still visible as a scar on the landscape, and is a core to order the design around (Figures 46 and 49).

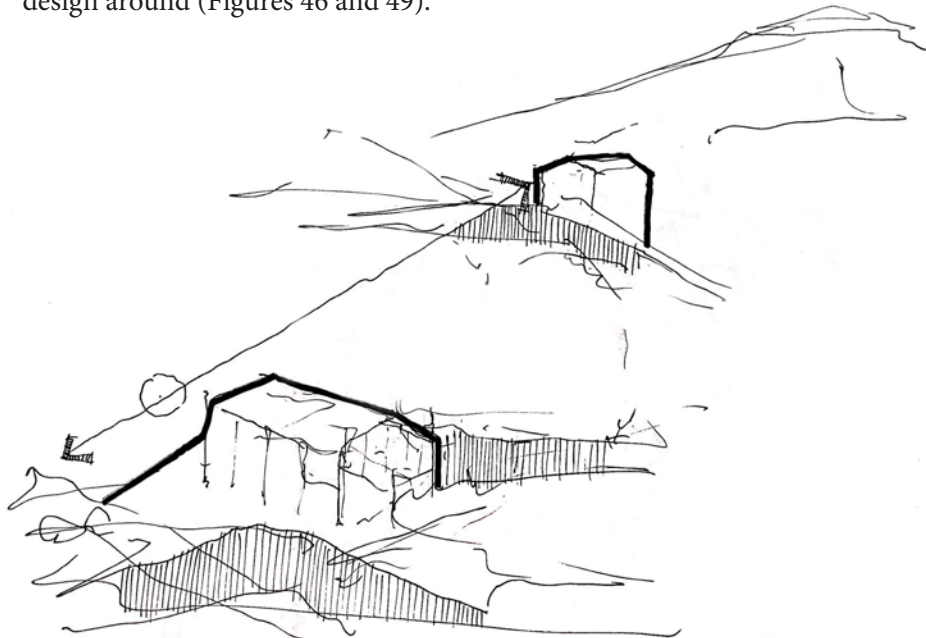


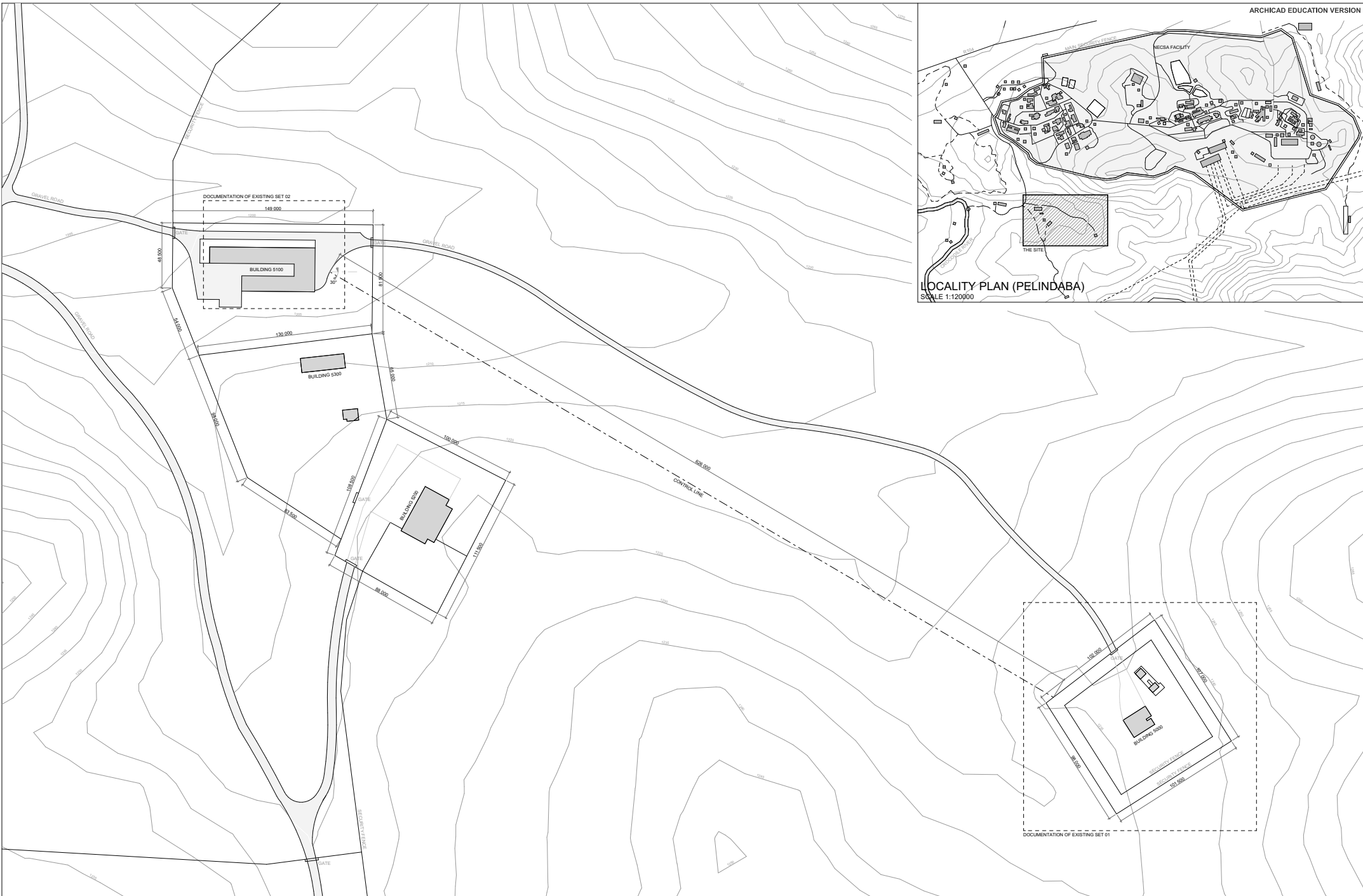
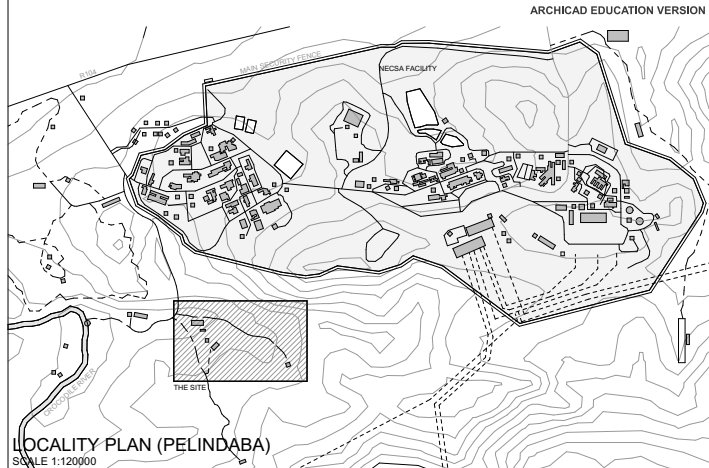
Figure 46: The control line (author, 2023).



Figure 47: Building 5000 in 2002 (Albright and Stricker, 2016).



Figure 48: One of the only public photos of 5100 (Albright and Stricker, 2016).



SITE PLAN
SCALE 1:1250

Figure 49: Site plan of existing buildings (author, 2023).



	TITLE	BUILDING 5000 SERIES	DATE	26/04/2023	SCALE	1:1250
	SHEET	SITE AND LOCALITY PLAN	DRAWN BY	A. NGIDI	SIZE	A1
CONTACT	ARWAN WOOD arwan@woodstudio.com	DESCR.	Documentation and illustrations are made to the best of our ability. Please. Make dimensions layout clear structural frame. Structure placed together from photographs and on site measurements. Drawings should not be used as a field guide for future structural view version.	DRAWN	DATE	1/1
REV.				PROJ. NO.	TECHNICAL	47

2.8.1 BUILDING 5000

The following photographs and documentation were able to be captured despite the many bars and restrictions preventing months of attempts to do so. The Pelindaba site is classified as a National Key Point. Standing in the empty centre of 5000 filled one with immense awe. What is left of the structure today is simply a metal shell (Figure 51). The steel shed has only small reminders of what it once held. Even though the structure is simple (Figure 52), the space is uncanny and chilling (Figure 53). The large interior is almost haunting in its void space.

As stated, Building 5000 was used to house a pulse reactor for the testing of computer models in the 1970s according to Albright and Stricker (2016: 38). However, Kelley (2020: 34) states that it is not a pulsed reactor and goes further to explain the functioning of that experiment. Essentially, the reactor stored in this building was used as a deconstructed gun-type nuclear bomb to measure potential yields of criticality from HEU metal (Figure 50). This is the ‘tickling of the dragon’s tail’ experiment, named so due to its terrible consequences if there were to be an accident.

The following documentation for Building 5000 was drawn after visiting the site, carefully measuring and examining the structure (Figure s 54-57).

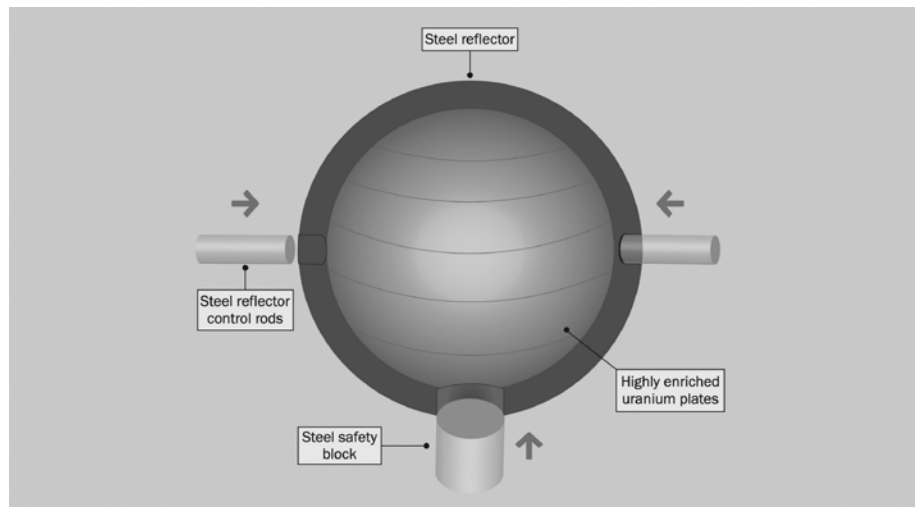


Figure 50: Basic diagram of the criticality reactor (Kelley, 2020).



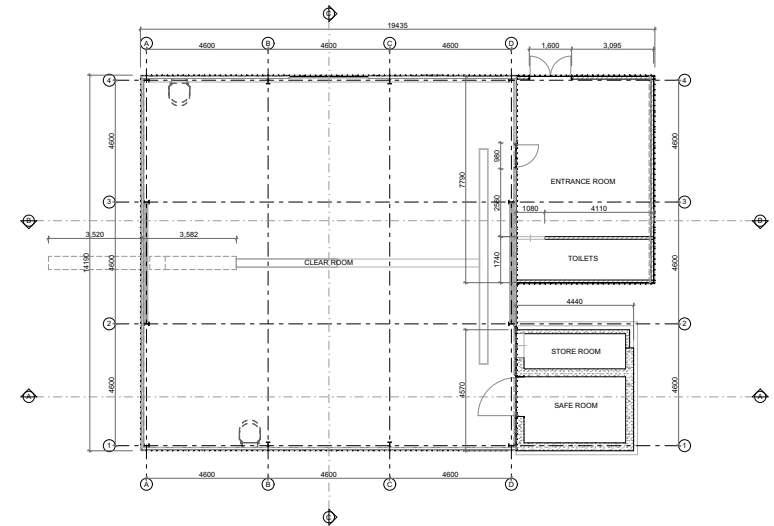
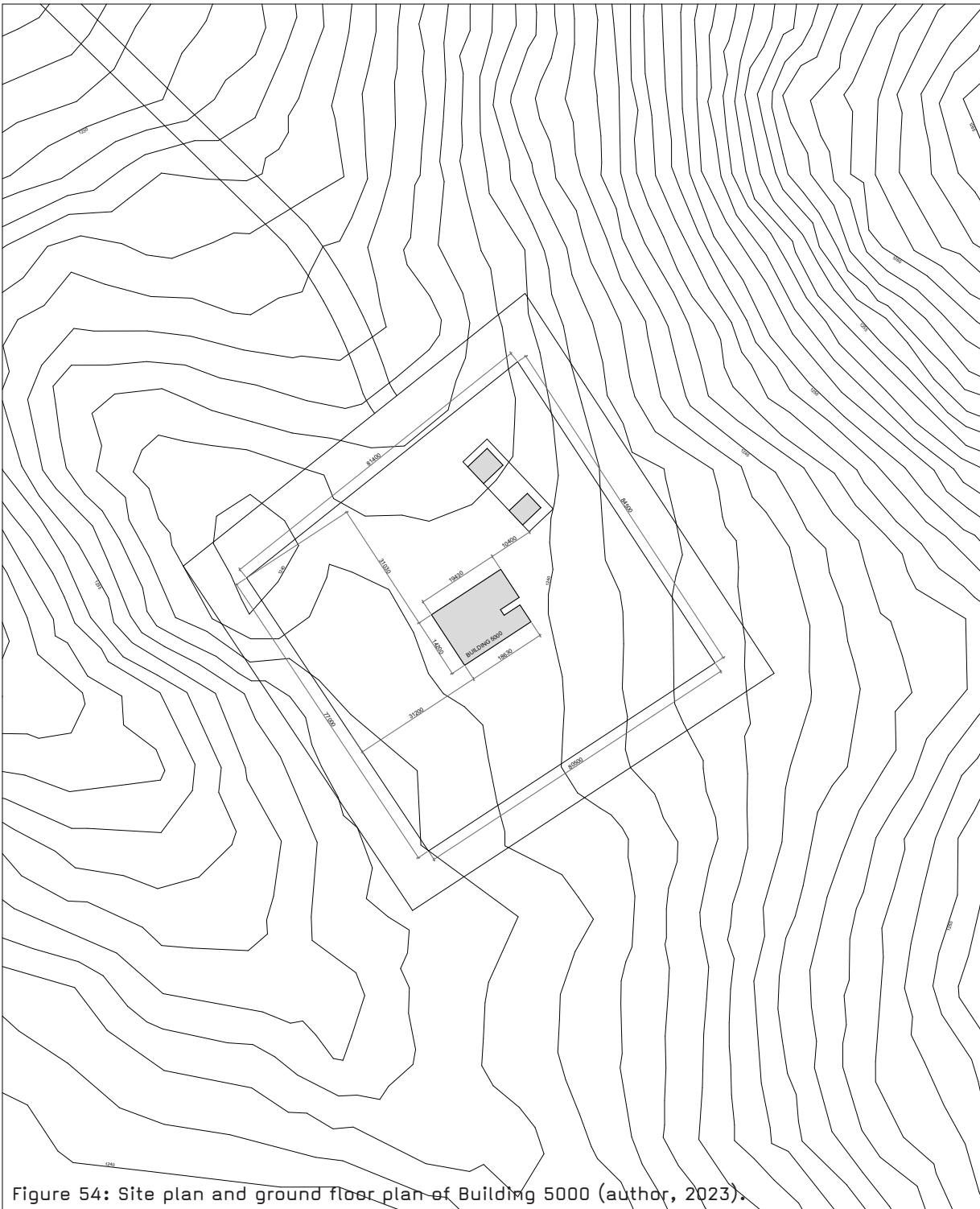
Figure 51: Building 5000 revealing itself (author, 2023).



Figure 52: The control line visible on the left (author, 2023).



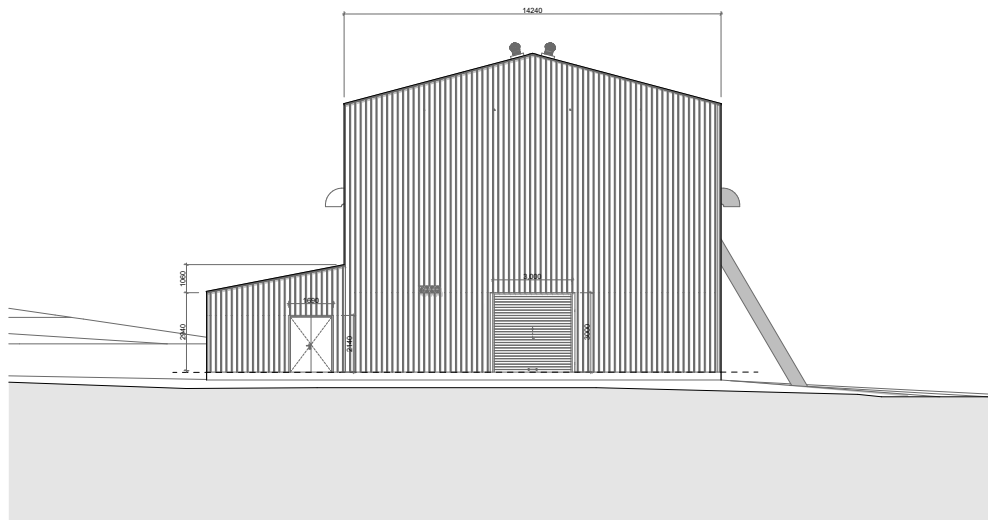
Figure 53: Simple steel shed (author, 2023).



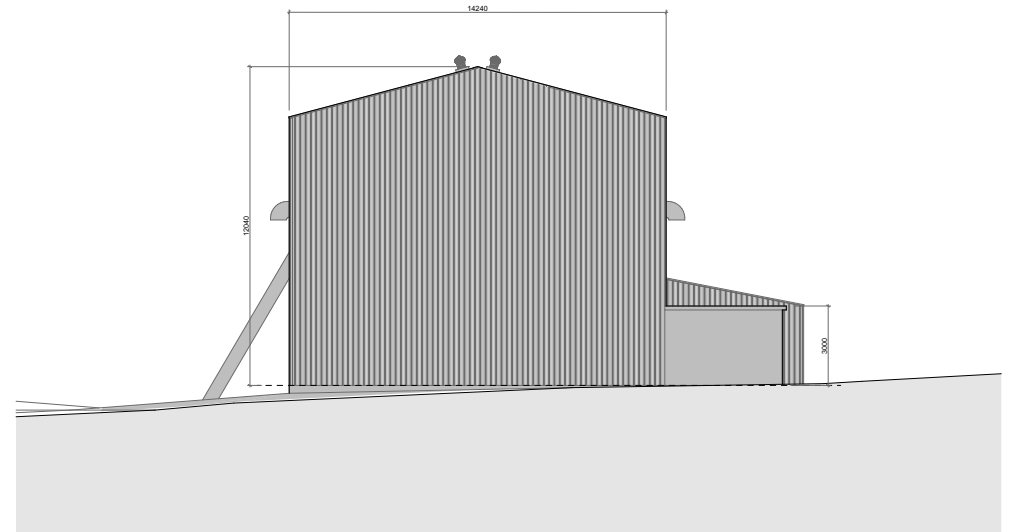
GROUND FLOOR

Figure 54: Site plan and ground floor plan of Building 5000 (author, 2023).

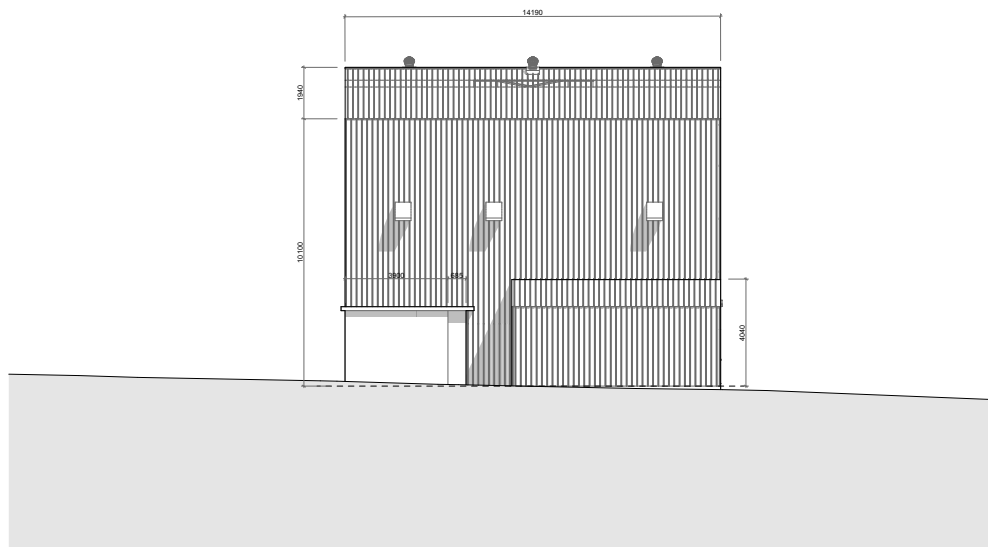
	TITLE	BUILDING 5000 TECHNICAL REPORT	DATE	20/04/2023	SCALE
	SHEET	SITE PLAN AND PLAN	DRAWN BY	A. WOOD	SIZE
CONTACT	0800 100 000 enquiries@wood.com	DESIGN	<small>Dimensions and descriptions are done to most clearly illustrate figures. Main dimensions layout steel structural frame. Structures placed together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.</small>		
REV		CHECKED BY	NA	PAGE	04
		DWG NO.	TECHNICAL 08		



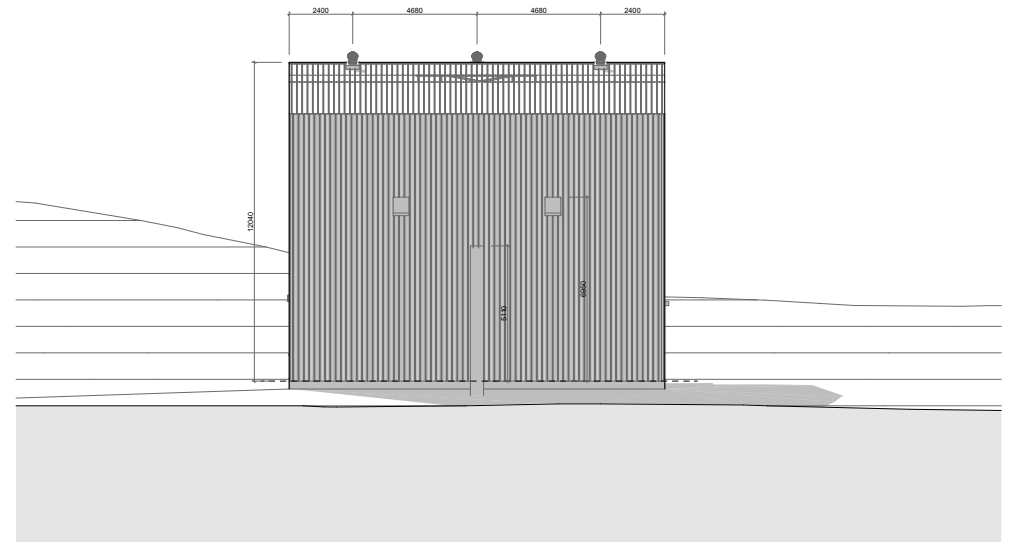
NORTH ELEVATION



SOUTH ELEVATION



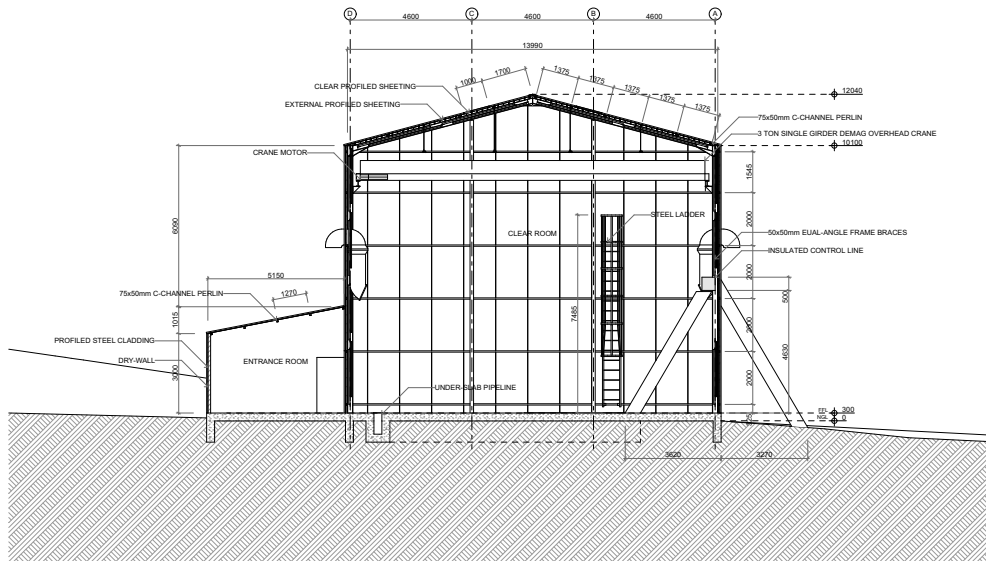
EAST ELEVATION



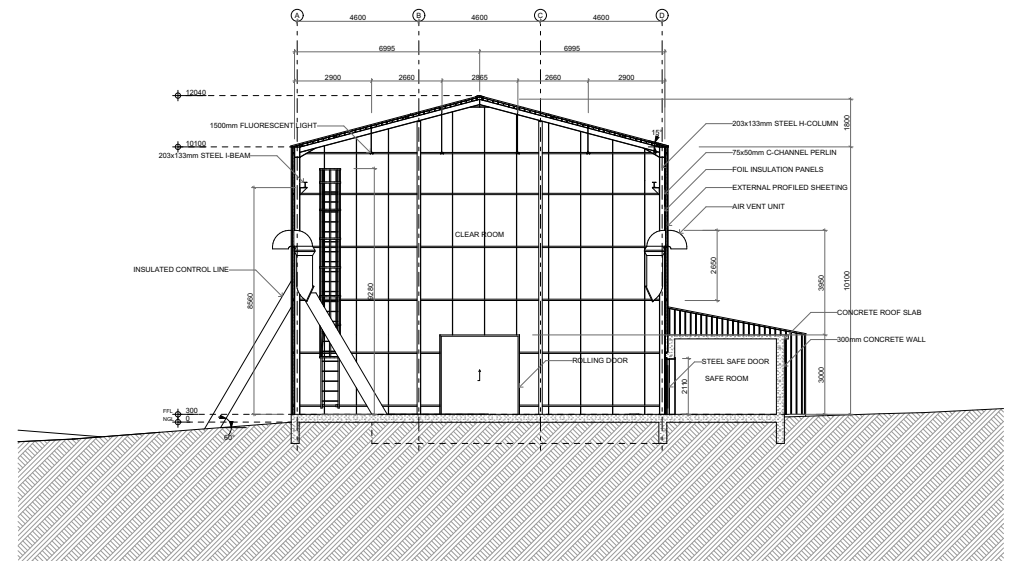
WEST ELEVATION

Figure 55: Elevations of Building 5000 (author, 2023).

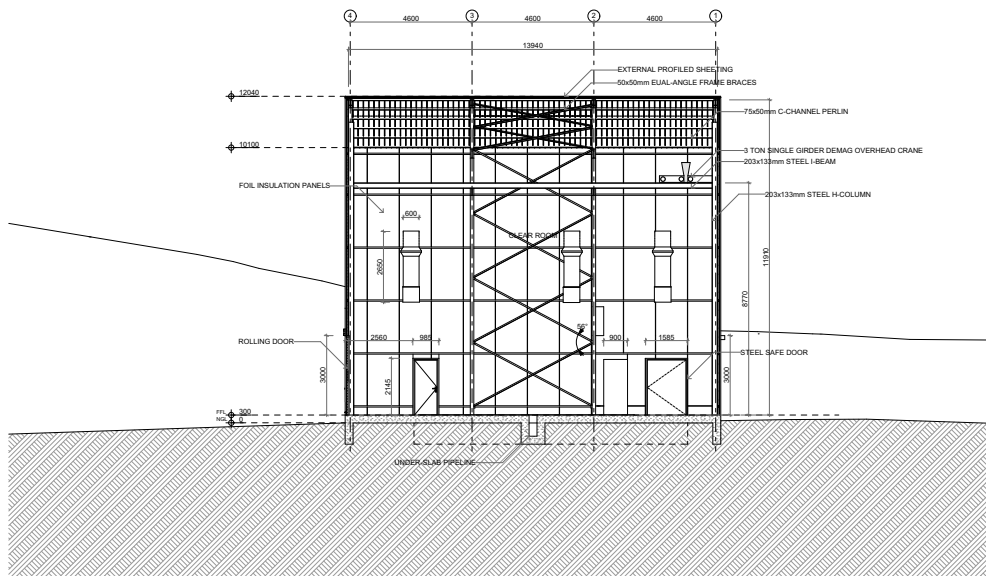
	TITLE	BUILDING 5000 TECHNICAL REPORT	DATE	20/04/2023	SCALE
	SHEET	ELEVATIONS	DRAWN BY	A. WOOD	SIZE
CONTACT	ARONAL WOOD	DESIGN		CHECKED BY	NA
EMAIL	aronwood@gmail.com	REV		DATE	2/4
				DWG NO.	TECHNICAL 08



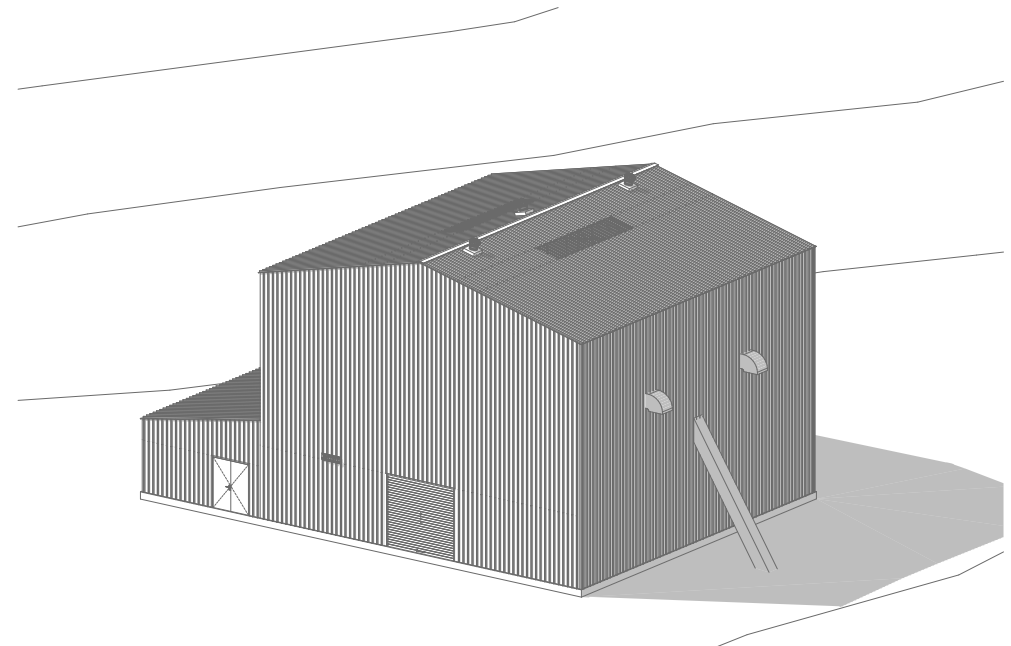
SECTION B-B



SECTION A-A



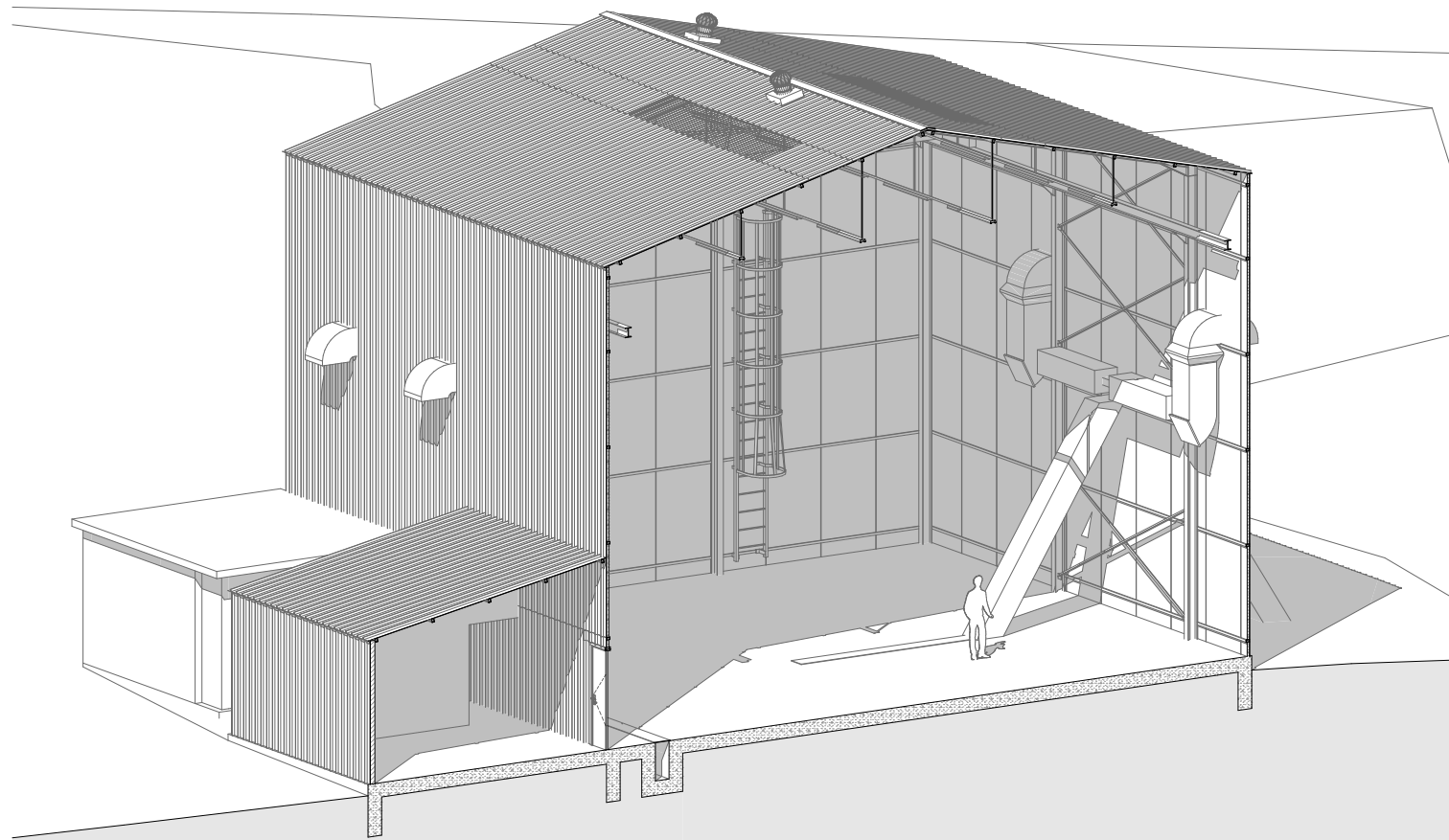
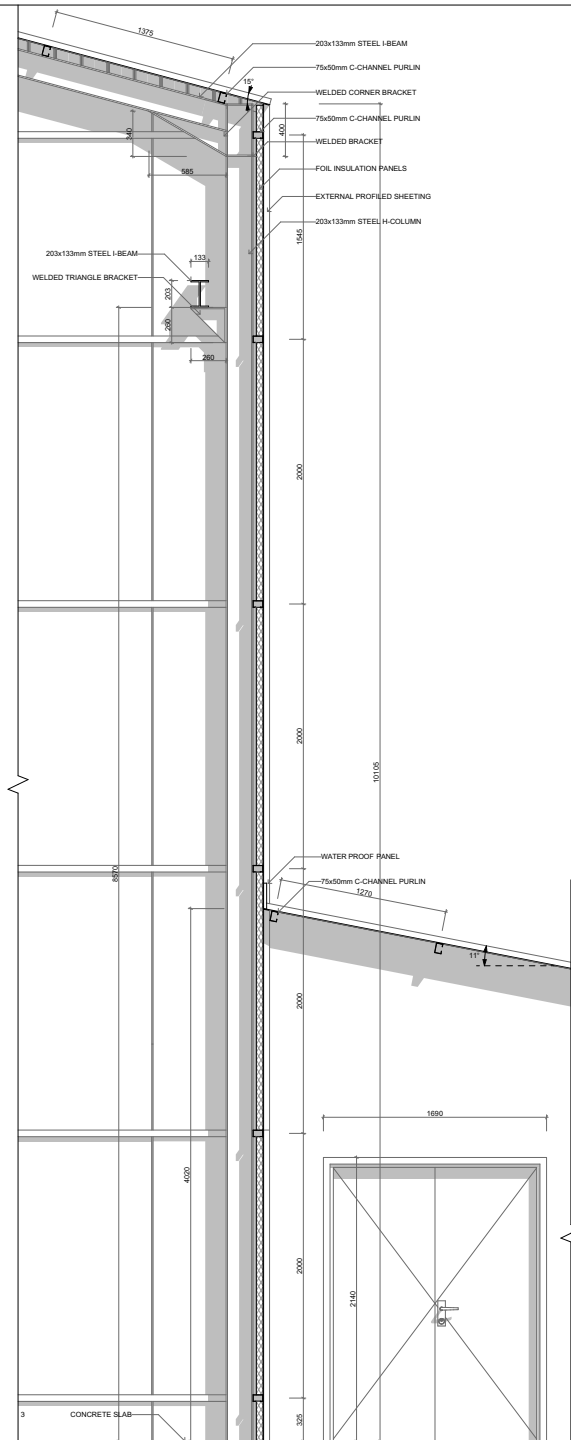
SECTION C-C



ISOMETRIC VIEW

Figure 56: Isometric view and sections of Building 5000 (author, 2023).

	TITLE	BUILDING 5000 TECHNICAL REPORT	DATE	20/04/2023	SCALE
	SHEET	SECTIONS	DRAWN BY	A. WOOD	SIZE
	DESIGN		CHECKED BY	N/A	PAGE
	REV		DATE		3/4
<small>Dimensions and descriptions are done to most clearly accurate figures. Main dimensions layout steel structural frame. Structures shown together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.</small>			<small>CONTRACT</small> 00000 00000 <small>PROJECT</small> 00000 00000 <small>CLIENT</small> 00000 00000 <small>DATE</small> 20/04/2023 <small>SCALE</small> 1:1000 <small>PAGE</small> 3/4 <small>PROJECT NO.</small> 00000 00000 <small>TECHNICAL 08</small>		



DETAIL SECTION

ISOMETRIC SECTION

Figure 57: Detail of structure of Building 5000 (author, 2023).

	TITLE	BUILDING 5000 TECHNICAL REPORT	DATE	28/04/2023	SCALE
	SHEET	DETAIL	DRAWN BY	A. WOOD	SIZE
CONTACT: JOURNAL 10000 info@woodjournal.com	REVISION	Dimensions and descriptions are done to meet client's requirements. Main dimensions layout steel structural frame. Structure joined together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.	CHECKED BY	N/A	PAGE
REV			DWG. NO.		TECHNICAL 03

2.8.2 BUILDING 5100

What is left of this structure lies in heaps of rubble and skeletal remains (Figure 58). The original building was mundane and stereotypical of the government buildings at the time (Bezuidenhout, 2023). Only a quarter of the original mass of the building remains (Figure 59). According to an anonymous source on the site, demolition was commenced due to the fact that parts of the building were made of asbestos.

Very little information exists on the original layout and functioning of the building. Demolition appears to have stopped by the end of 2019 and the building has remained in its current state since (Figure 60). The same simple steel type of structure that was used to construct Building 5000 appears to have been used in the construction of this building as well. The portion that is left behind was used for “separating the isotope lithium-6 from natural lithium (Albright and Stricker, 2016: 41). The steel structure left behind surrounds a brick two-story bay for this experimentation.

The documentation for Building 5100 on the following pages was drawn after visiting the site, carefully measuring and examining the structure (Figures 61-64).



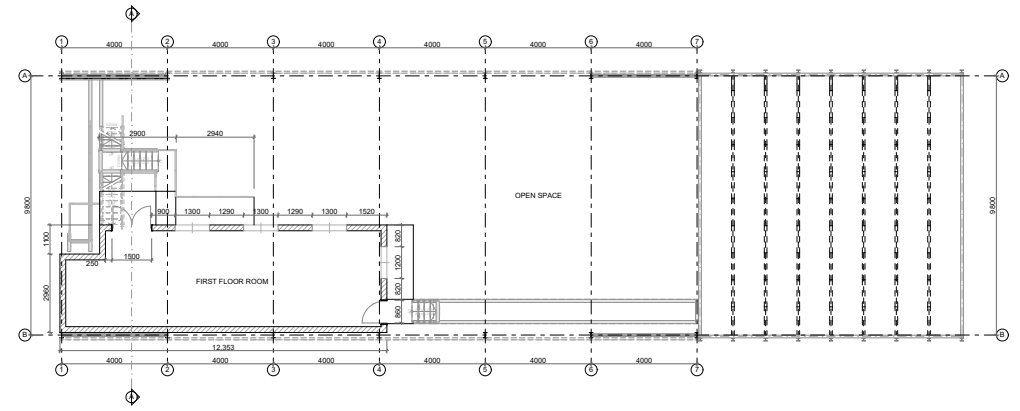
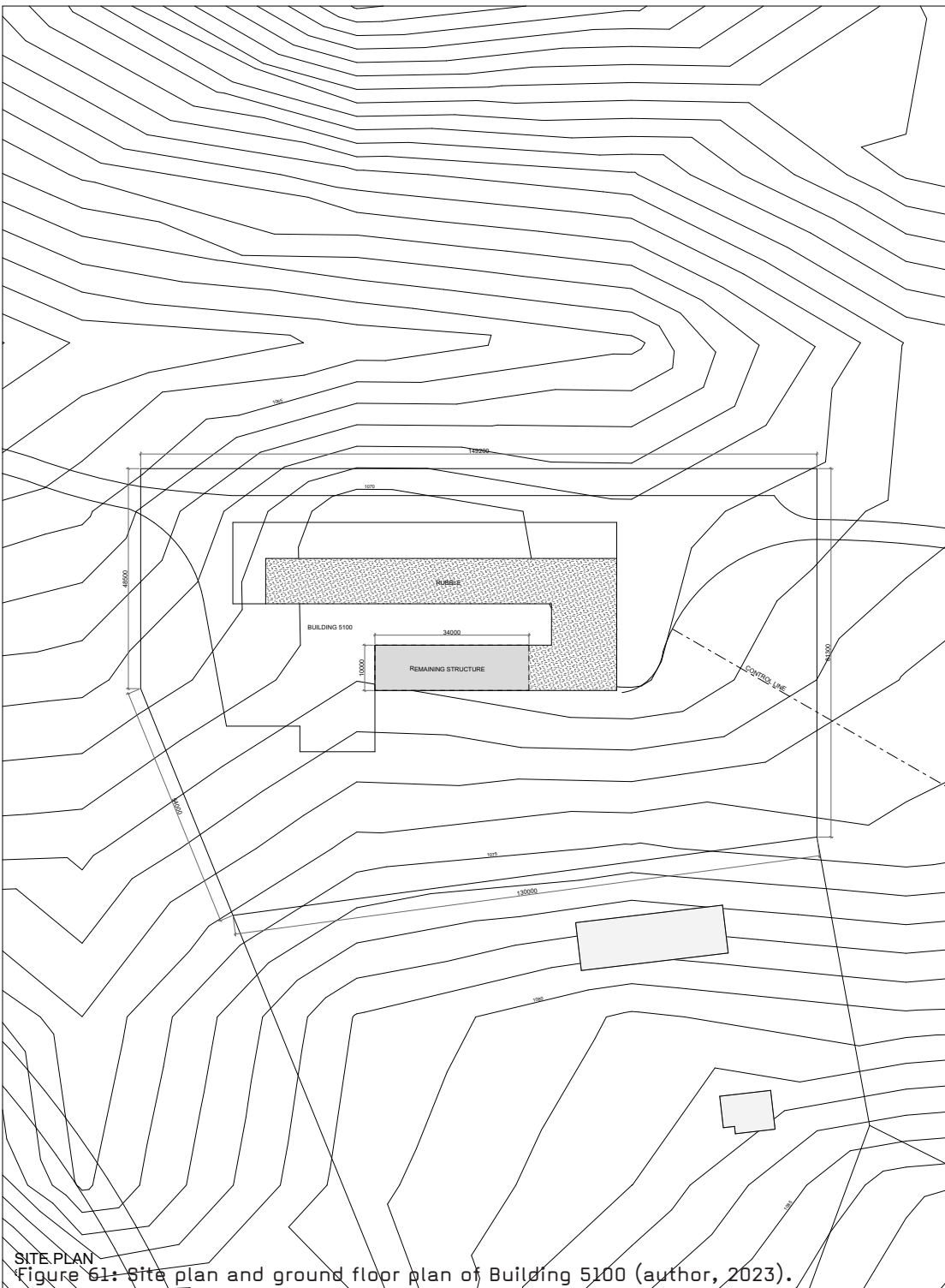
Figure 58: Building 5100 revealing itself (author, 2023).



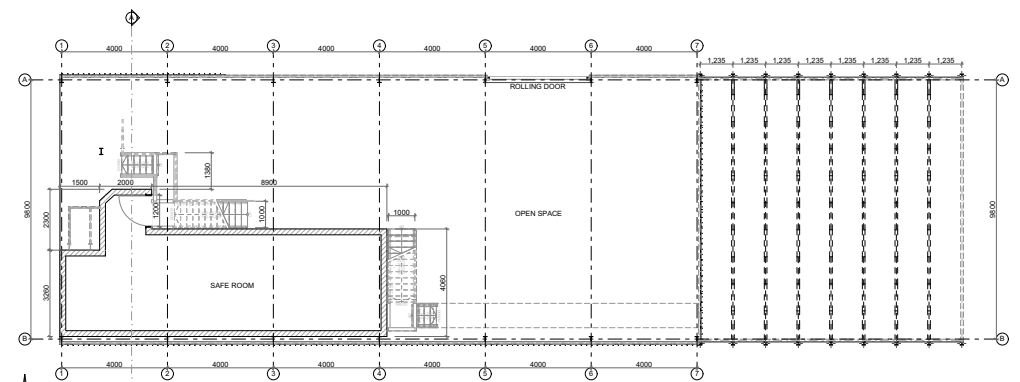
Figure 59: Exposed skeletal structure (author, 2023).



Figure 60: Poetic moments of destruction (author, 2023).



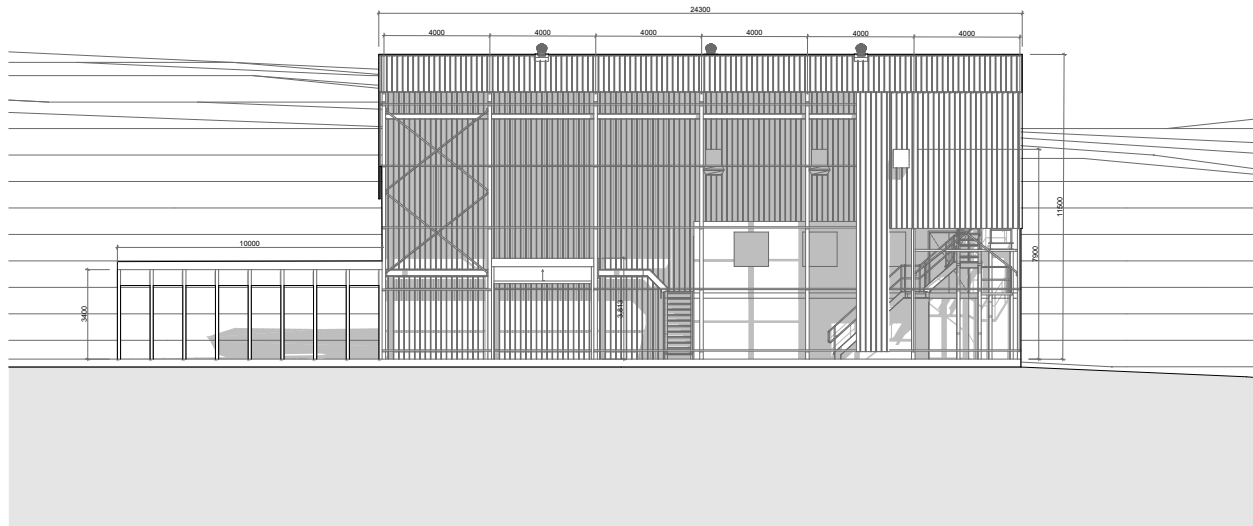
FIRST FLOOR



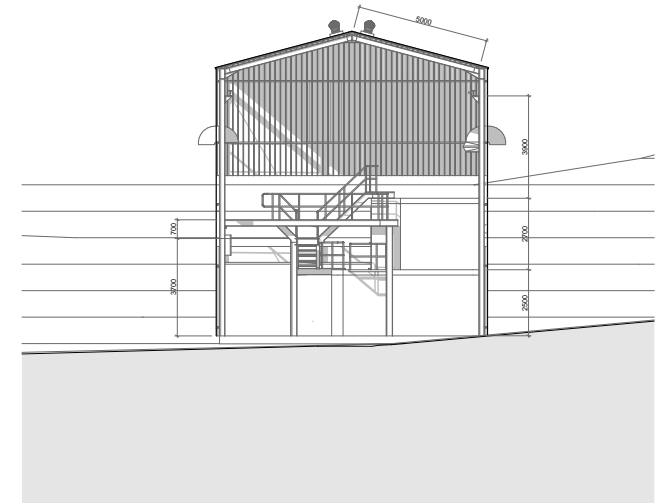
GROUND FLOOR

SITE PLAN
Figure 61: Site plan and ground floor plan of Building 5100 (author, 2023).

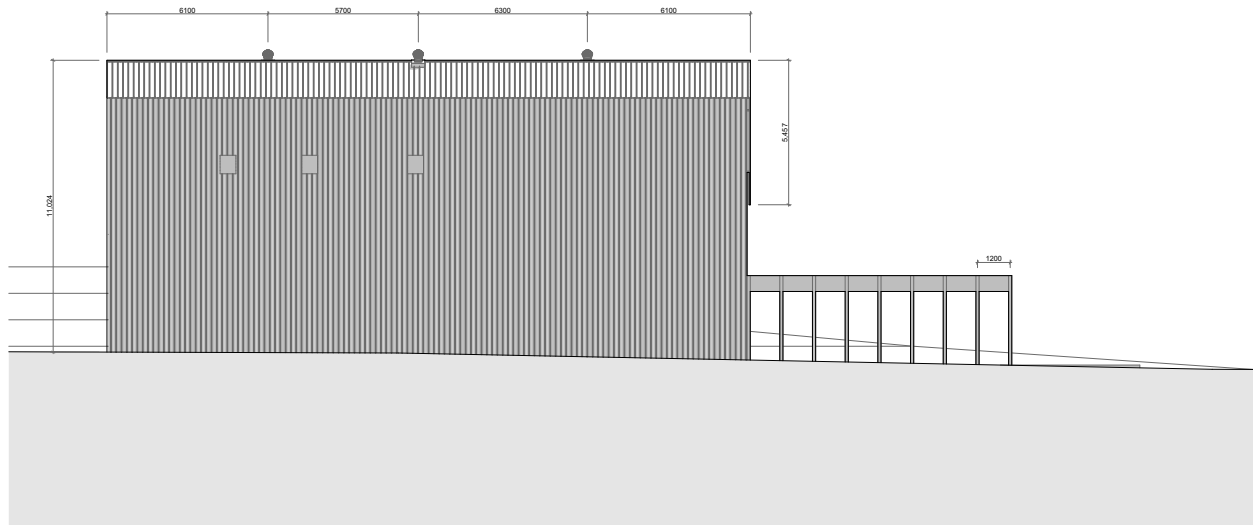
	TITLE	BUILDING 5100 TECHNICAL REPORT	DATE	2024-03-23	SCALE
	SHEET	SITE PLAN AND PLAN	DRAWN BY	A. WOOD	SIZE
CONTACT	303.444.9122 awood@woodgroup.com	DESIGN	Dimensions and descriptions are done to most closely approximate figures. Main dimensions beyond steel structural frame. Structure shown together from photographs and on-site measurements. Drawings should not be used as a strict guide for future structural intervention.		
REV		CHECKED	NA	PAGE	14
		DWG NO.	TECHNICAL 08		



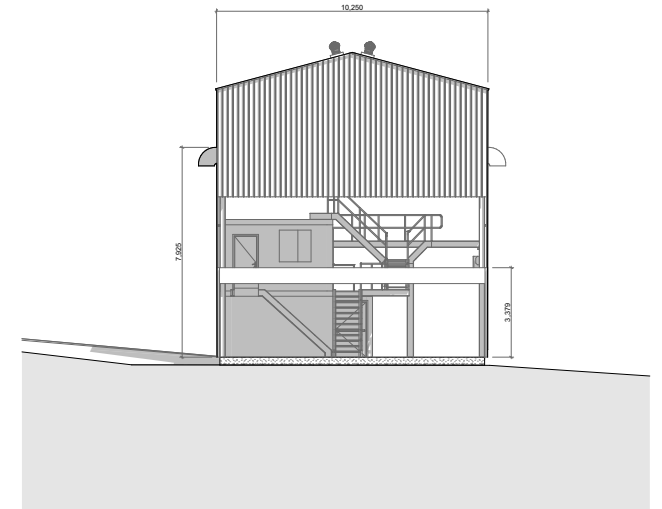
NORTH ELEVATION



WEST ELEVATION



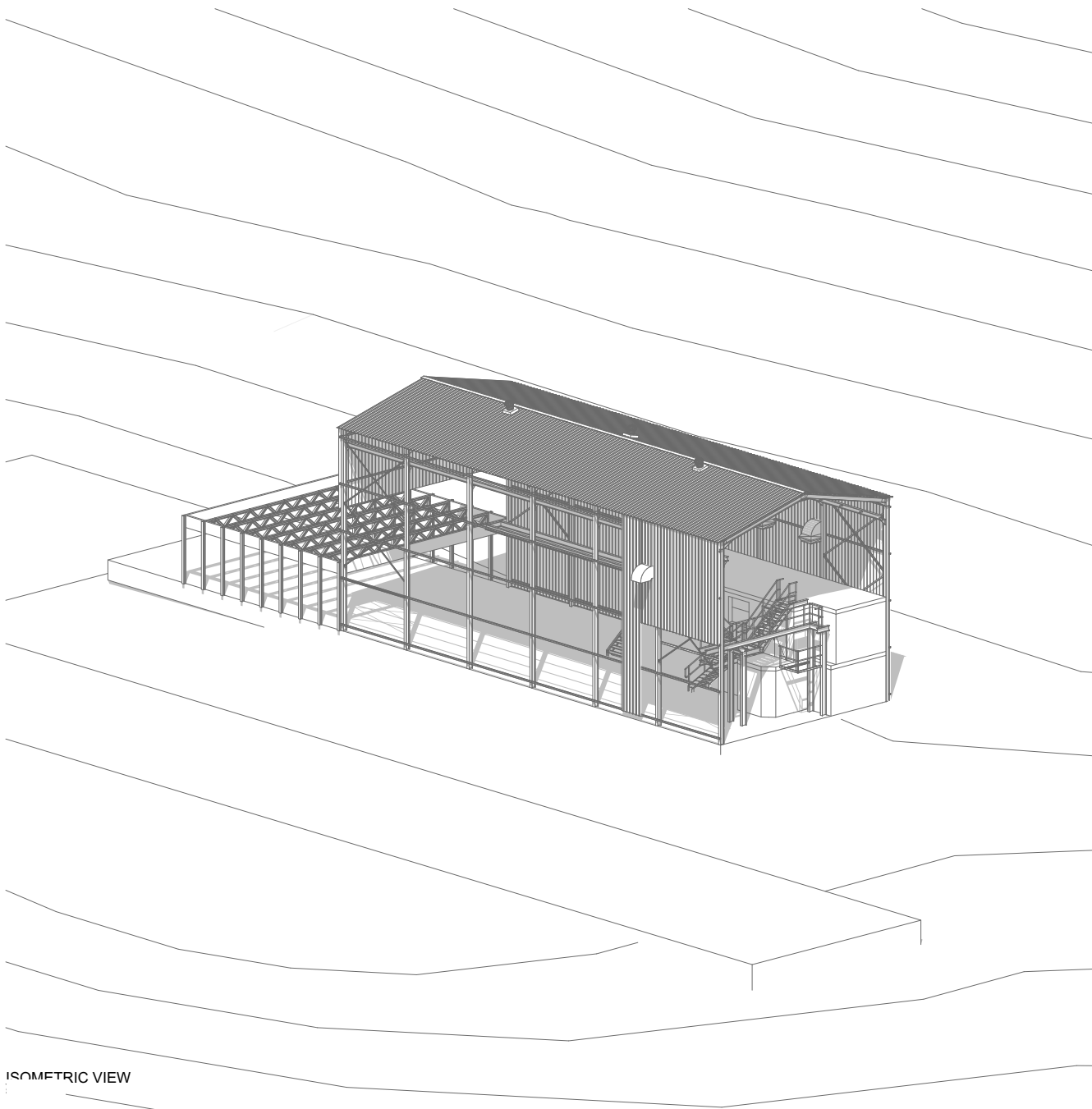
SOUTH ELEVATION



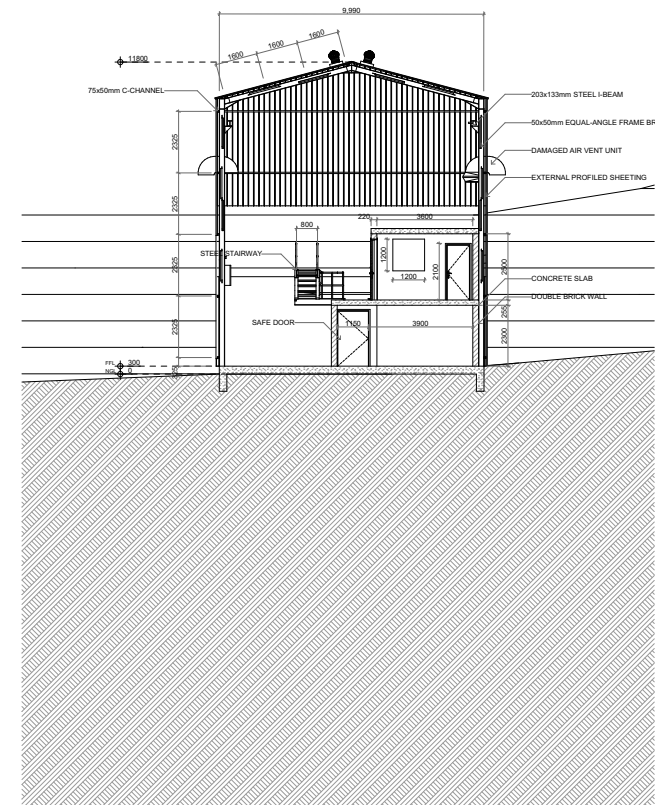
EAST ELEVATION

Figure 62: Elevations of Building 5100 (author, 2023).

	TITLE	BUILDING 5100 TECHNICAL REPORT	DATE	20/04/2023	SCALE
	SHEET	ELEVATIONS	DRAWN BY	A. WOOD	SIZE
CONTACT: JORDAN WOOD jwood@woodgroup.com	DESIGN	Dimensions and descriptions are done to most closely accurate figures. Main dimensions layout steel structural frame. Structure placed together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.	CHECKED BY	N/A	PAGE
REV			DWG NO.		2/4
					TECHNICAL 08



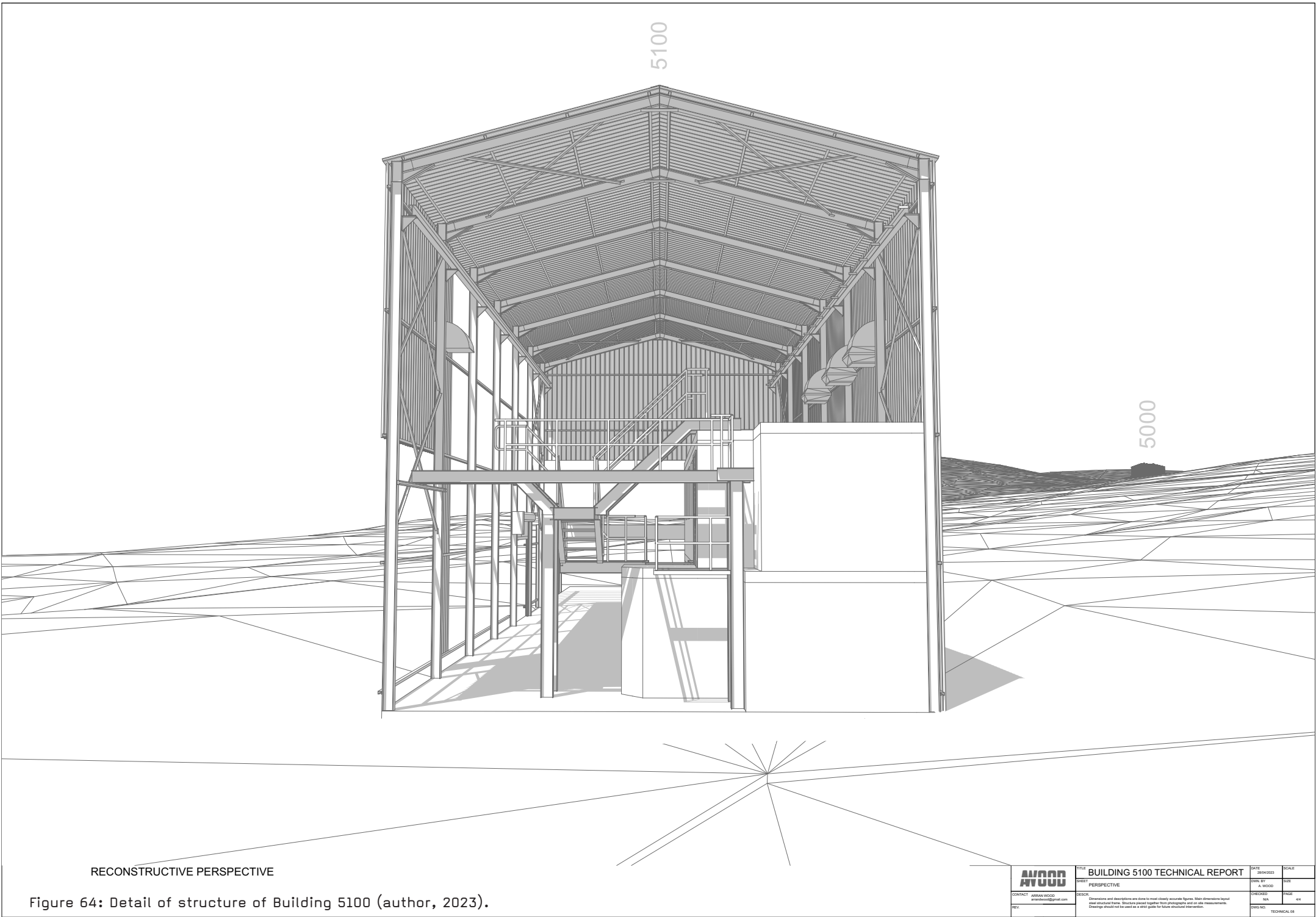
ISOMETRIC VIEW



SECTION A-A


Figure 63: Isometric view and sections of Building 5100 (author, 2023).

	TITLE	BUILDING 5100 TECHNICAL REPORT	DATE	20/04/2023	SCALE	1:1000
	SHEET	SECTION	DRAWN BY	A. WOOD	SIZE	A1
CONTACT: JORDAN WOOD jwood@woodgroup.com	DESIGN	Dimensions and descriptions are done to most closely describe figures. Main dimensions layout steel structural frame. Structure placed together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.			CHECKED BY	N/A
REV					DWG NO.	TECHNICAL 08



RECONSTRUCTIVE PERSPECTIVE

Figure 64: Detail of structure of Building 5100 (author, 2023).

	TITLE	BUILDING 5100 TECHNICAL REPORT	DATE	20/04/2023	SCALE	
	SHEET	PERSPECTIVE	DRAWN BY	A. WOOD	SIZE	
CONTACT: JORDAN WOOD jwood@wood.com	DESIGN	Dimensions and descriptions are done to meet clearly accurate figures. Main dimensions layout after structural frame. Structures placed together from photographs and on site measurements. Drawings should not be used as a first guide for future structural intervention.			CHECKED BY	NA
REV					PAGE	4/4
					DWG NO.	TECHNICAL 03

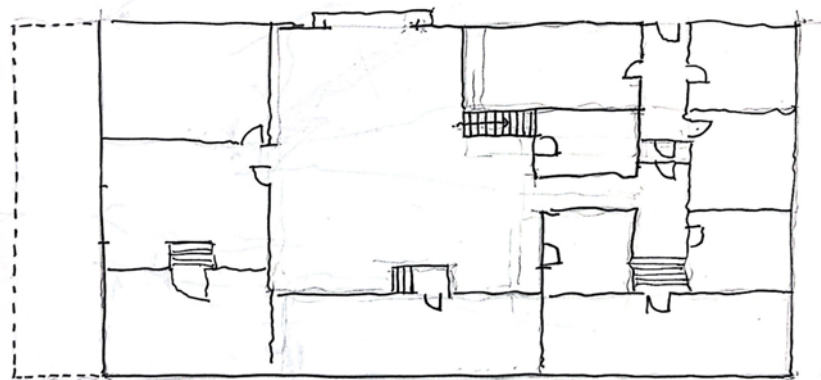
2.8.3 BUILDING 5200, 5300 AND MAGAZINE

The function inside Building 5200 seem to be much more debatable than the other buildings (Figure 65). It housed a gas gun which was used for explosive testing as well as a variety of other functions. The building today is utilized by a company that wishes to remain anonymous. It has been renovated several times so it is difficult to tell what is original versus new structure (Figure 66). Internal photographs cannot be publicly shared due to the sensitivity of the production within.

Building 5300 (Figures 67 and 68) is a small assemblage of rooms that were used for producing and testing small explosive devices. The building is hidden in the trees with a low roof. For the most part it is a non-descript layout. All the 5000 series buildings seem to be incredibly utilitarian.

The nearby magazine (Figure 69) was used to store explosives and sensitive material. The walls are roughly one meter thick with a hidden concrete roof and steel safe doors. The floor is made from old timber planks. It is rumoured that South Africa's nuclear devices were stored here but they were more likely stored at the Kentron Circle facility.

No technical documentation was done on these structures due to the restrictions on the buildings.



BUILDING 5200

Figure 65: Building 5200 floor plan sketch from memory (author, 2023).



Figure 66: Building 5200 revealing itself (author, 2023).



Figure 67: Outside of Building 5300 (Albright and Stricker, 2016).



Figure 68: Path to Building 5300 (Albright and Stricker, 2016).



Figure 69: The heavy walls of the magazine (author, 2023).

2.9 CONCLUSION

Understanding South Africa's nuclear posture necessitates exploring the perspectives and historical context of those in power at the time. This historical context was shaped by the Cold War and the global ideological struggle between the "traditional West" and the "Communist viewpoint," characterized by a relentless race for technological and military advancements. The Cold War dynamics reshaped global politics. The USSR's support for "national-liberation wars" and involvement in African affairs significantly influenced alliances, especially in regions like Angola.

The external involvement of government states in that sensitive area acted as a catalyst for conflict. These are the conditions in which the nuclear programme was created. Although incredibly more complex even than described here, the context does lay the groundwork for the basis of this thesis. Design is highly influenced by history and context, and it is important to take this into consideration.

The site analysis is a compilation of documents found in research, new photographs, drawings and models of the site (Figure 70) completed for the purpose of this thesis. The photographs are the first publicly released photos since the ones taken in 2002 found in *Revisiting South Africa's Nuclear Weapons Program* by David Albright and Andrea Stricker. The drawings aid in understanding the structure and skeletal remains of what is left behind. The buildings are only ghosts of what once existed on the site, a potentially terrible industrial machine, situated neatly in the everyday landscape and activities of the Hartbeespoort Dam area.

With the established contextual layering, the next chapter presents the initial conceptual development for architectural intervention.

BUILDING 5100

BUILDING 5300

BUILDING 5200

BUILDING 5000

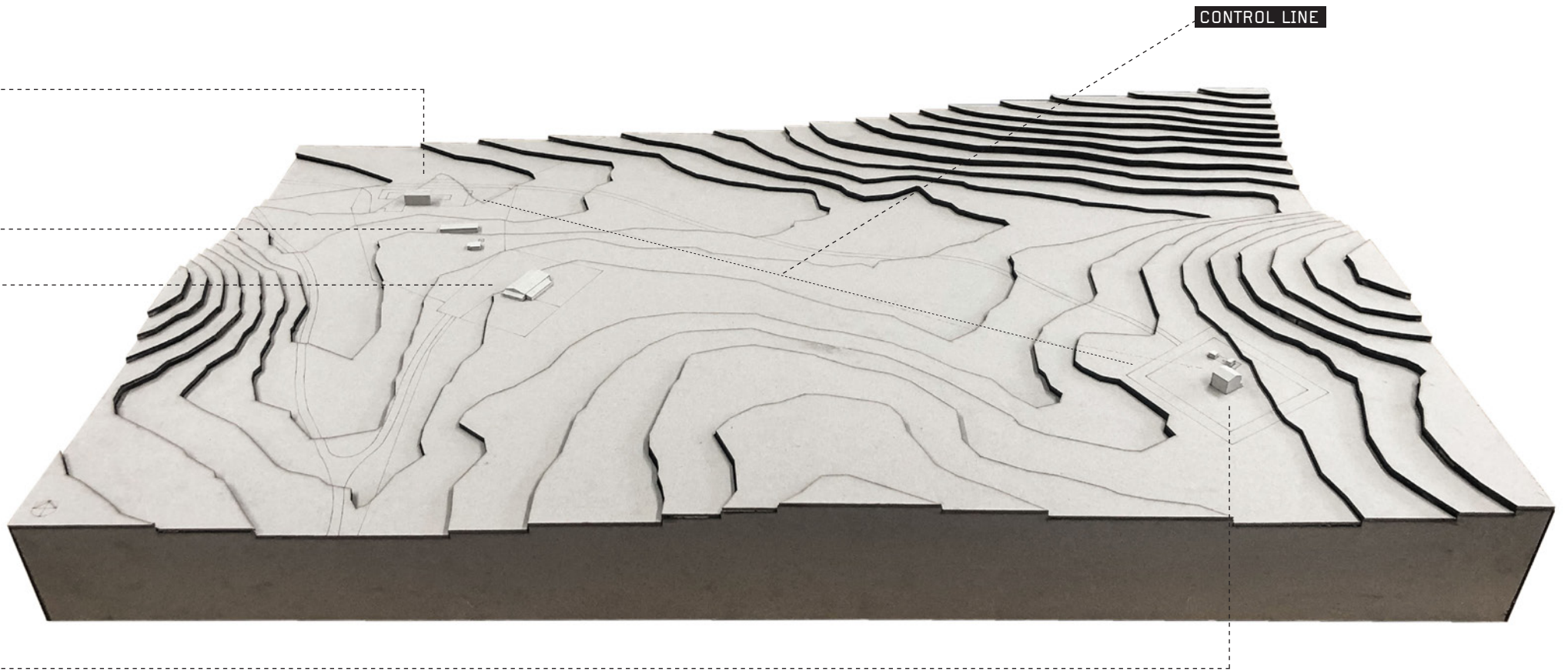


Figure 70: Site model showing existing, contours at 5m (author, 2023).

CHAPTER 03

CONCEPTUAL APPROACH



The glove box used in the experiments on solvent
Figure 71: Nuclear tectonics (AEB, 1976). 65

3.1 INTRODUCTION

With the backdrop of the historical canvas, a design intention can be based on site-specific realities. The conceptual work is the first dive into developing a response to the site and proposal in form (Figure 72). The touchstone develops the idea of a response, not in an architectural language, but still contributes form to the background of this thesis. The design concepts following the touchstone attempt to begin to find ideas that can contribute rather to the architectural form in response to place and history. These design interrogations are done through explorative sketches and physical models, as well as the touchstone demonstration.

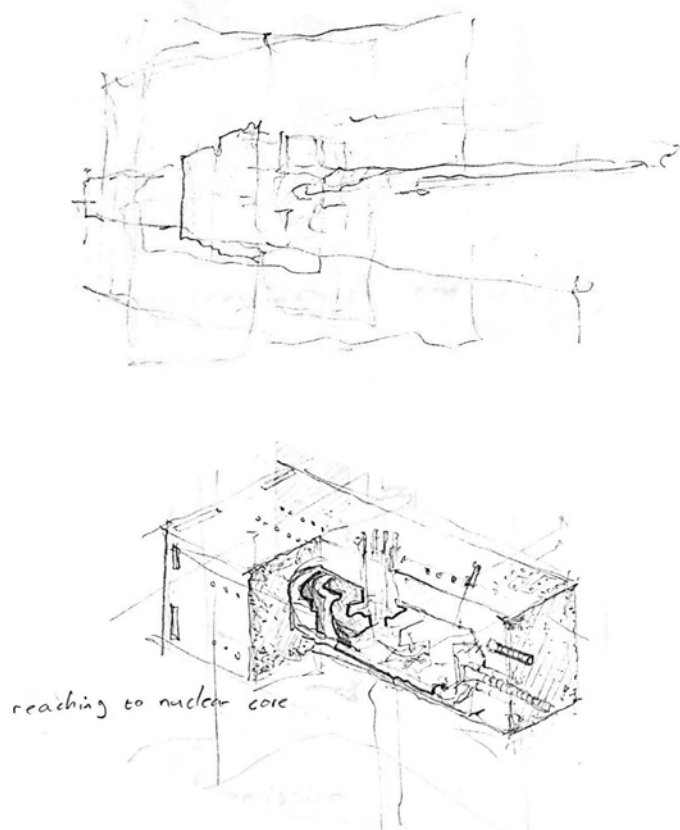


Figure 72: Reactor morphology (author, 2023).

3.2 FLESH-WITNESSING

The touchstone holds the purpose of being a demonstration of what the project and theory as a whole can be measured against. It is a tectonic guide as much as guiding the decisions for the design (Figure 73). This first attempt is uninformed by the future endeavours in theory and conceptual work, meaning it only houses some of the theoretical developments. However, it is the first stone on which the rest of this project is built and can still contribute to the understanding of the overall design (Figure 74).

What does it mean to witness? Flesh-witnessing can be told as an impossible experience to describe and something that must be undergone oneself in order to understand. Military experience, especially combat, is deeply involved with the restricted knowledge that comes with this type of witnessing. The eye-witness sees things but does not experience them, and the eye-witness has proliferated across the globe via media broadcasts and video recordings. The result is that many become a witness to conflict without ever ‘flesh’ witnessing it, a dynamic brought about by the technology in use today and never tested before on the subject of the human.

Such conditions create rifts in understanding between people. It is difficult for the experiences of one veteran to overcome the grand narrative of media in many cases. In the search for clarity of remembrance of war, those who fought should not be forgotten. Even though the communication of such experiences faces many barriers, it should be addressed, and the revealing of the flesh-witnesses among us should be acknowledged.

The touchstone is a demonstration that illustrates the revealing of a flesh-witness and the structure’s decommission. Only when a conflict fought in silence is brought into the open can it be remembered honestly. But only when one actually enters into a physical remembering can the process be exposed for all to see. Through a melting and pouring out of making the unseen seen, we might get a better understanding of what it is that those who bear lasting scars still carry today. It is the demonstration of lifting that becomes the touchstone, not merely the object itself.

The demonstration exists in three phases (Figures 75-78). The first is when the device is unlit and the subject inserts his hand, gripping the bar and making ready. The next phase is igniting the device to melt the loaded ink capsules and allowing the frozen ink to begin to run down. Lastly, the machine is revealed by lifting of the device so the dripping black stain can be seen by all and the protracted form is exposed.

Here is the flesh witness, and there becomes the eye-witness; the demonstration completes itself.

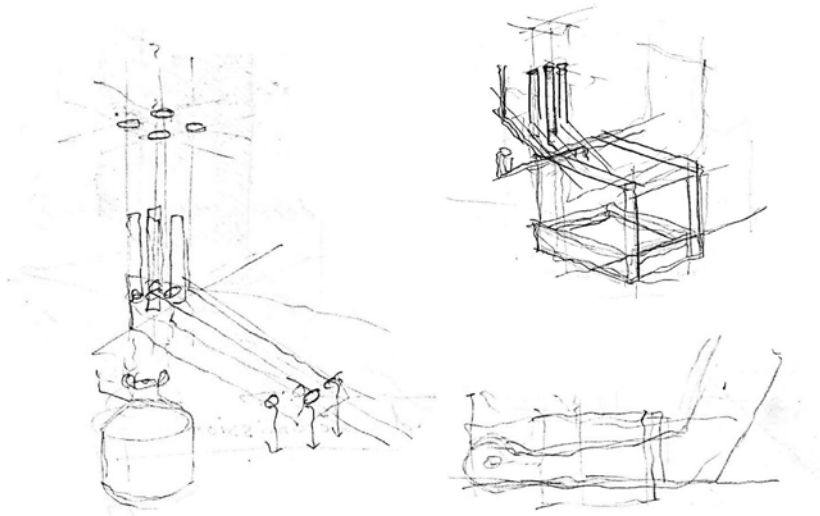


Figure 73: Initial conceptual design, burner (author, 2023).

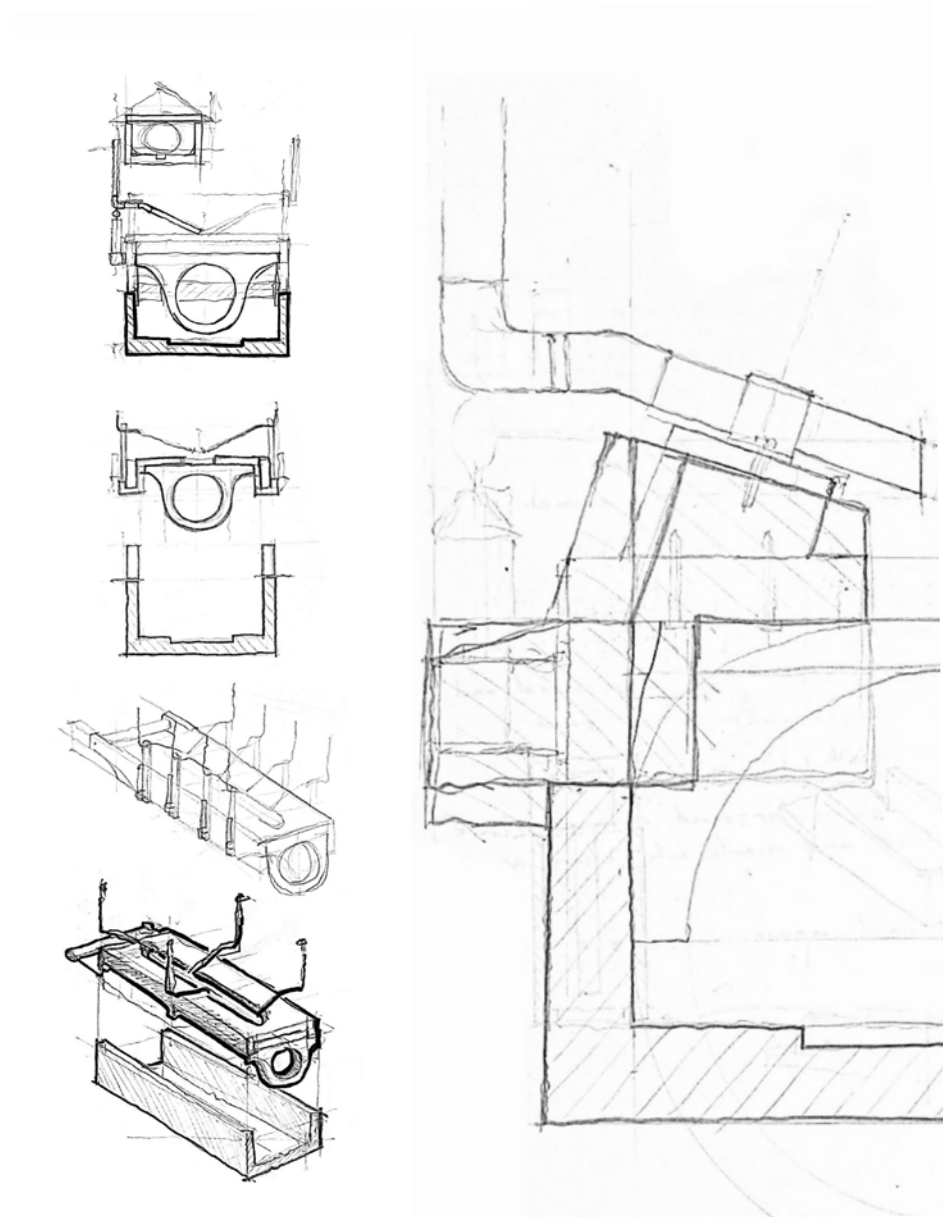


Figure 74: Sectional development of the device (author, 2023).

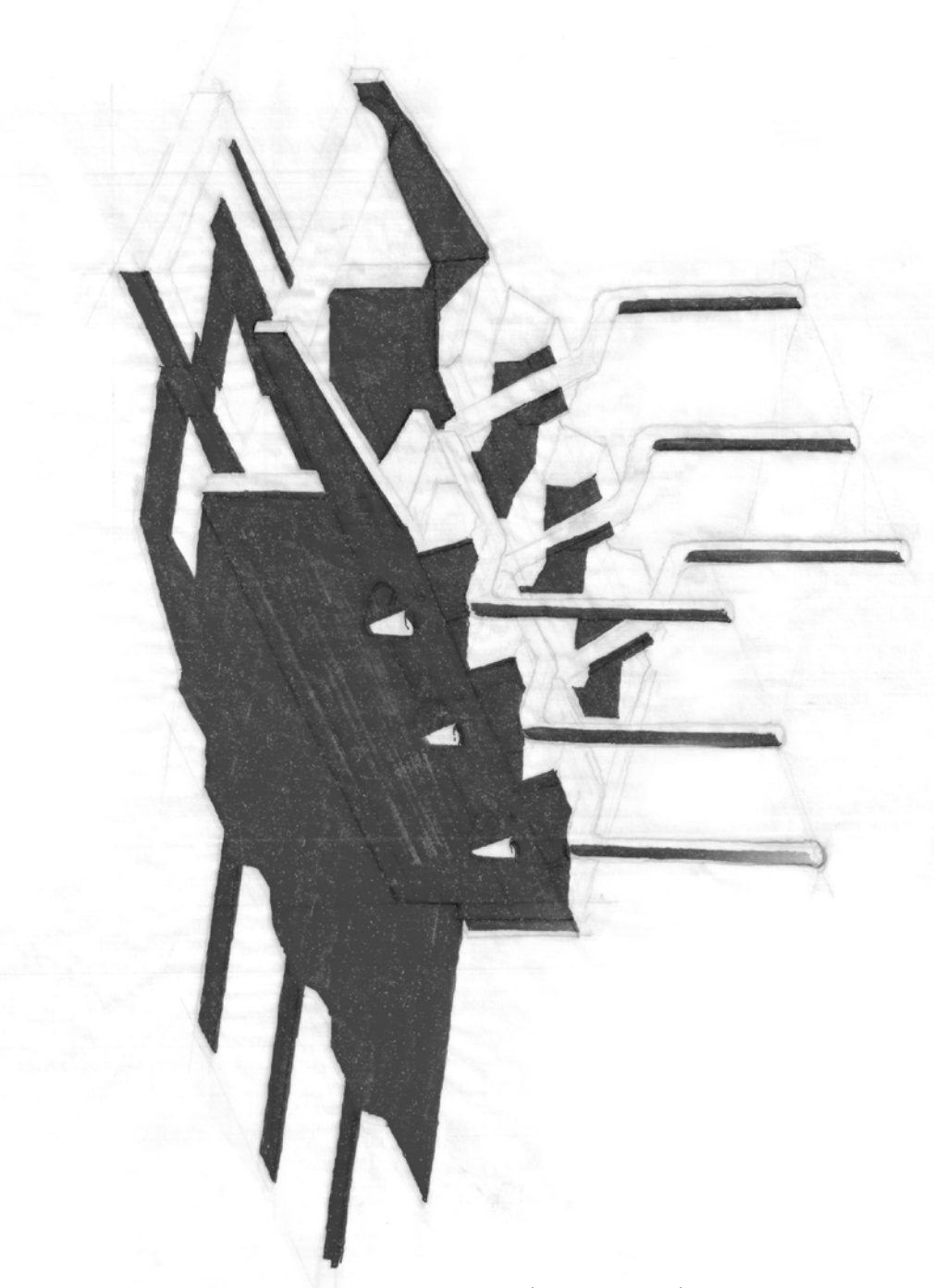


Figure 75: A dark exploration of form (author, 2023).

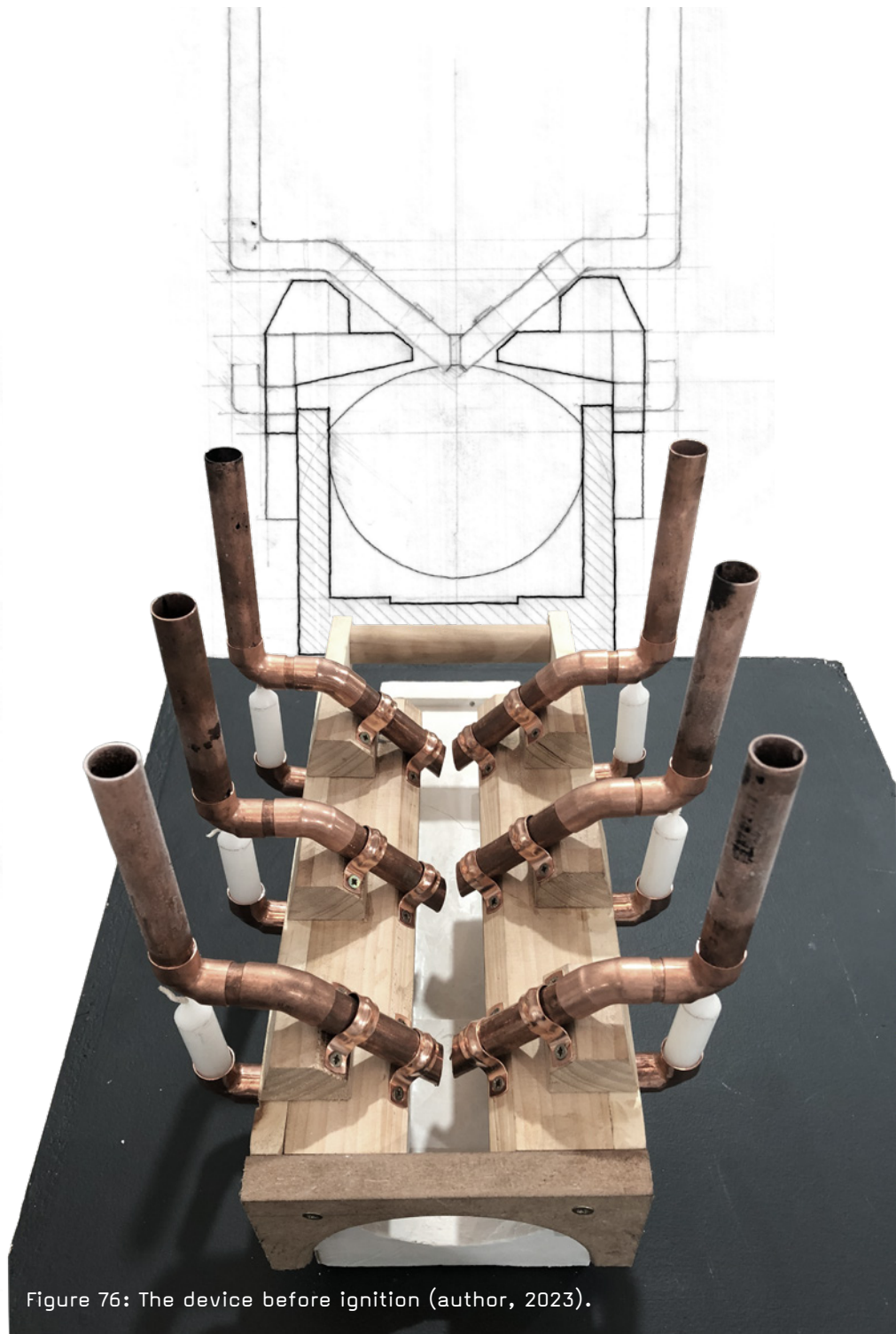


Figure 76: The device before ignition (author, 2023).



Figure 77: The reveal (author, 2023).



Figure 78: The lasting marks (author, 2023).

3.3 DRAWING IRON-CURTAINS

The first design concept attempts to establish a response to the hidden environment of the programme and the site (Figure 79). The buildings are situated in the hilly landscape in such a way as to hide themselves from prying eyes as well as shield themselves from each other in case of a nuclear accident. The site's physical conditions are concealed in the hills, and so was the programme in the context of the time. It was described as “consistent with concealment via ‘terrain masking’” (Albright and Stricker, 2016: 30) when discussing hiding the programme from the view of the main Pelindaba site.

“Thus, any dragon-type reactor must be built with safety as a primary concern, and it must be operated carefully. South Africa apparently attempted to mitigate this danger in several ways. It built Building 5000 at the bottom of a depression surrounded by hills in an isolated portion of its main nuclear site. The control room was in Building 5100, which was almost three-quarters of a kilometre away and shielded from the reactor by a hill.” (Albright and Stricker, 2016: 36).

The concept (figure 80) also speaks to the divide the world saw at the time, the Cold War. The divide between East and West was physically manifested in the Berlin Wall, and so much was concealed through that Iron Curtain, as it was called. The ‘iron curtain’ named here also refers to the immovability of the concealment of South Africa’s programme. It is a drawing out (revealing) from the concealed curtain, an interpretive drawing of (interpreting) that curtain and a drawing (opening) of curtains that have been closed for so long (Figure 81).

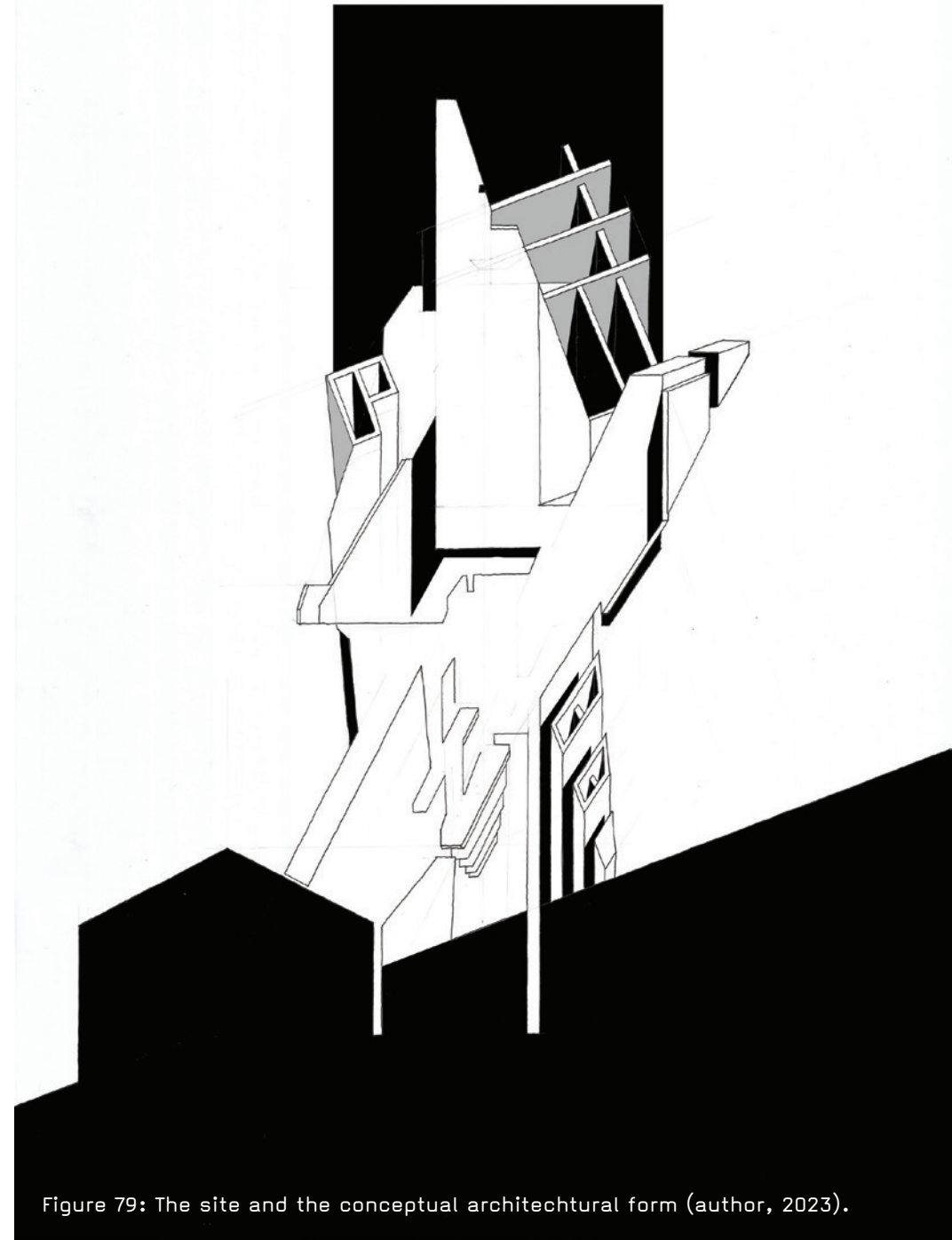


Figure 79: The site and the conceptual architectural form (author, 2023).

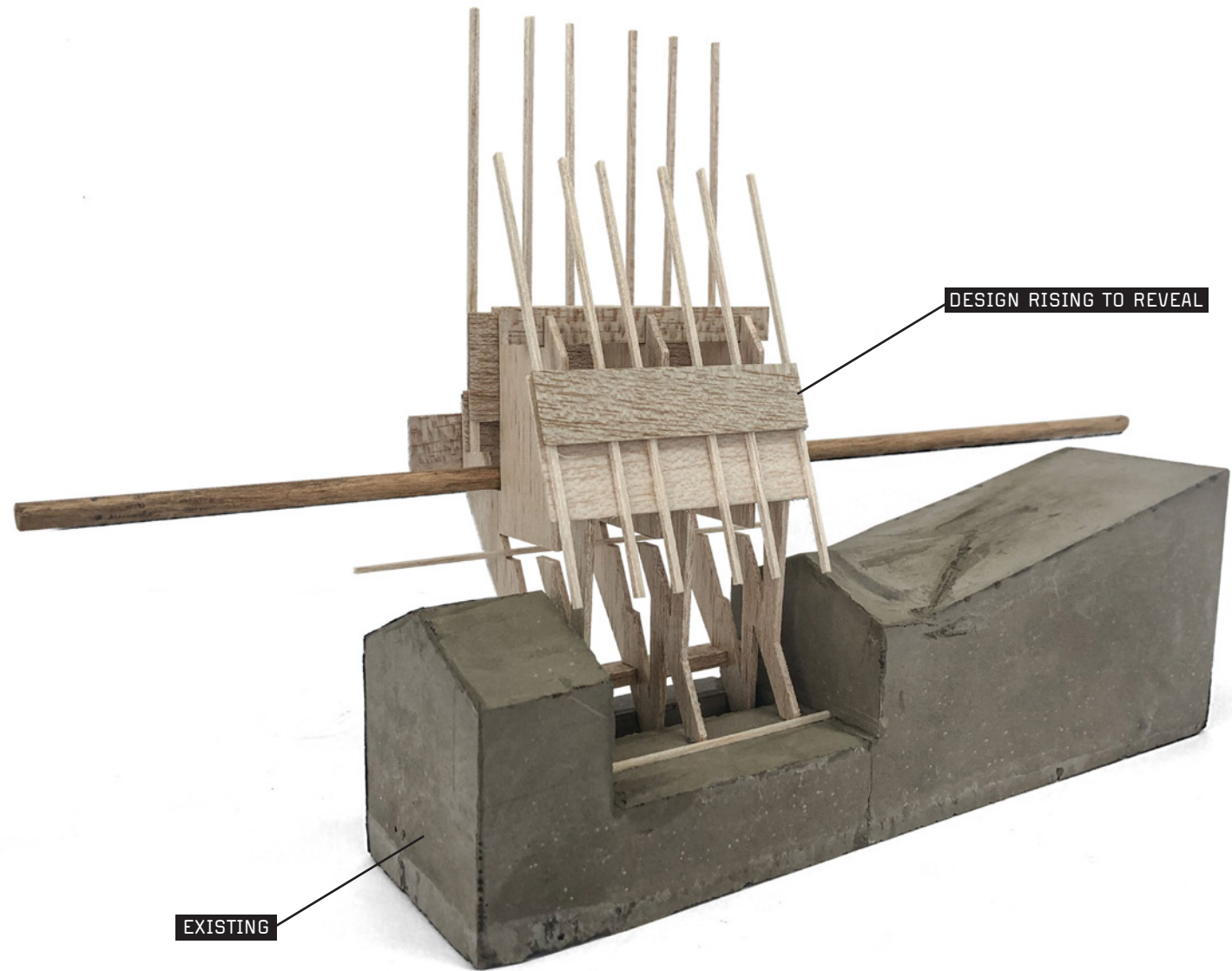
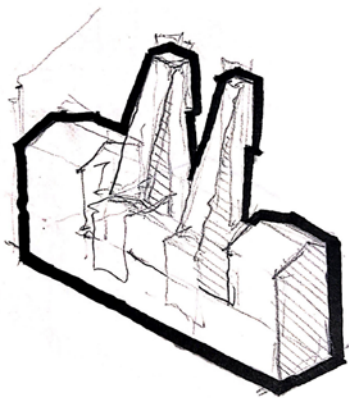
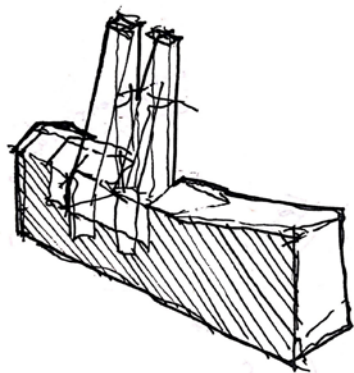
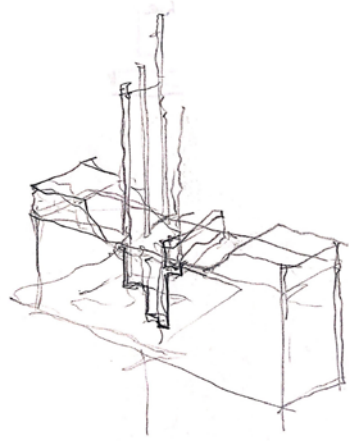


Figure 80: Sketch process, existing vs revealing (author, 2023).

Figure 81: Drawing out of design (author, 2023).

3.4 VISIBLE MACHINERY

A foundry in collaboration with a place for historical remembrance brings a fascinating relationship into play. The secure and secret processes can now be exposed to witnesses, allowing for more reflection on the machines we invoke during conflict (Figures 82-84). The symbolic deconstruction and reconstruction process is an essential representation to the beholder. This conceptual development is explicitly meant for the foundry and how it fits into the whole programme—stretching the machinery confines of censorship to reveal the mechanisms within.

The dismantlement of the structure of the machine gives a much greater picture of the hidden. Even though it is entirely concealed exactly how the nuclear weapons were dismantled, it is possible to reference this unknown disassembly by allowing for a re-dismantlement suggestive of the past. It is an insight into the dismantlement of weapons and the nuclear programme without knowing what happened.

The architectural suggestion of this concept reveals itself through the play on traditional industrial forms and the ideas of how these forms can be manipulated to be the becoming of morphology that demonstrates the process of production - thus allowing the public to see into the censored (Figure 85), a melting and pouring of the solid and cold.

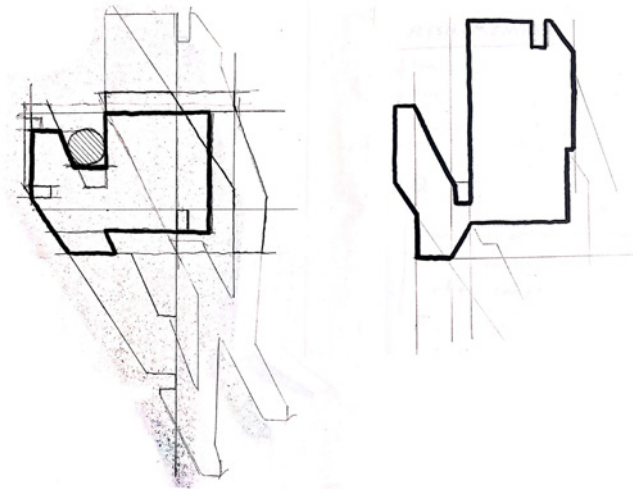


Figure 82: The parts of the machine (author, 2023).

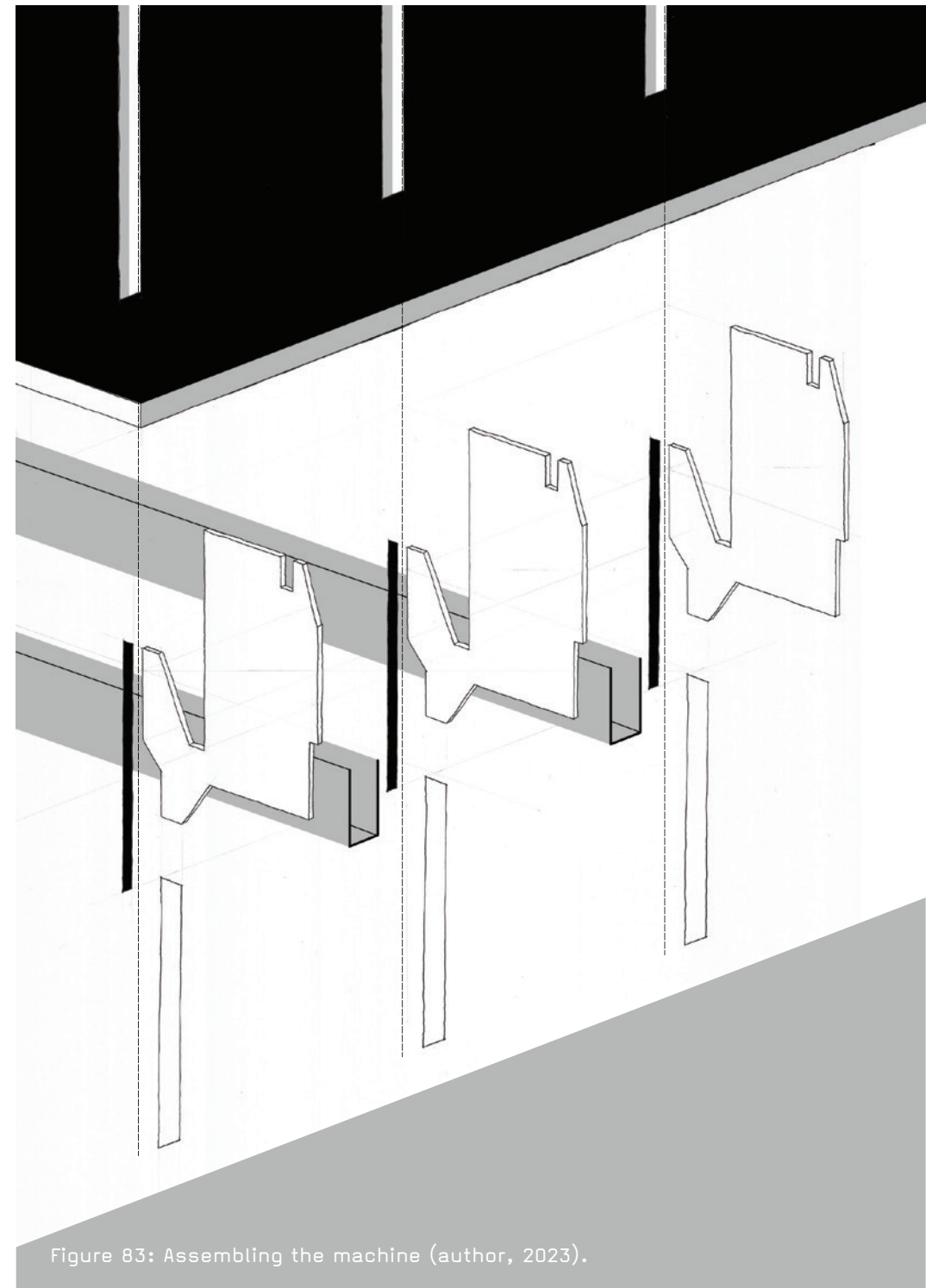


Figure 83: Assembling the machine (author, 2023).

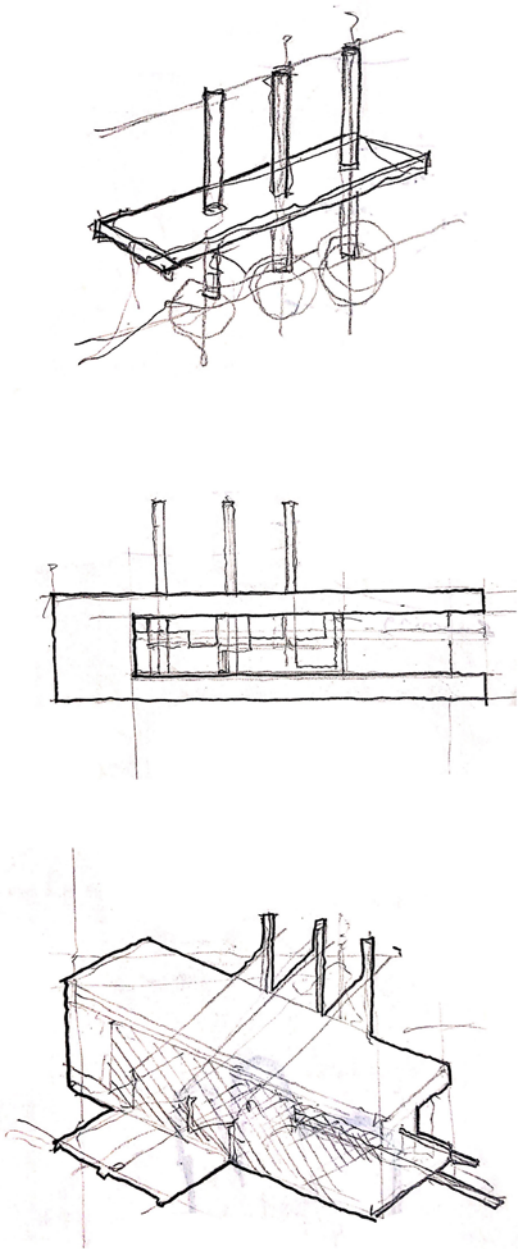


Figure 84: Sketch process, discovering industry (author, 2023).

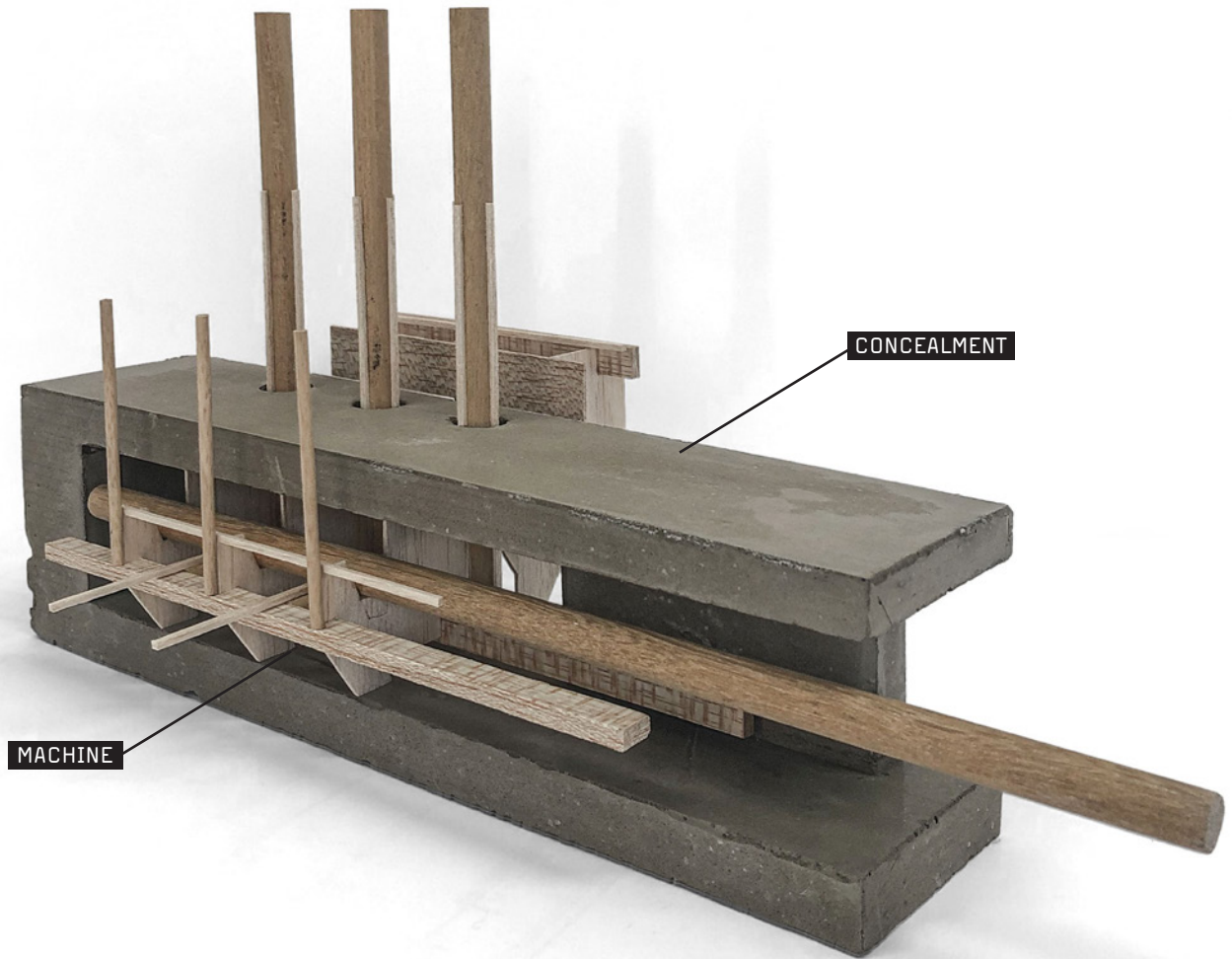


Figure 85: Exposing the machine (author, 2023).

3.5 REMEMBRANCE

The ternary exchange of this thesis is a complex fusion tied together by the 'ever-shifting' record of history : the concrete site, the deathless imprint of witnessing and the structure of the decommission (Figure 86). The third architectural concept is an attempt to find a way in which the three main elements of the programme can find a cohesive whole.

Even though separate individuals share assumptions and values that organise memory into roughly similar patterns, individuals cannot share another's memory any more than they can share another's mind. They share instead the forms of memory.

Therefore, how can form be shaped to trigger memory (Figure 87)? The architecture of the vague and specific shapes of memory is elusive. Still, the mysterious relationship of creating space that can inform carefully is the overall connecting conceptual development that lies at the core of this project. How can a drawing together of the three main ideas become a continuous ungraspable shape of remembrance? This conceptual development is the core (Figure 88), is most linked to the historical context, and the reason why placing the memory of the Border War together with the nuclear weapons programme is so important.

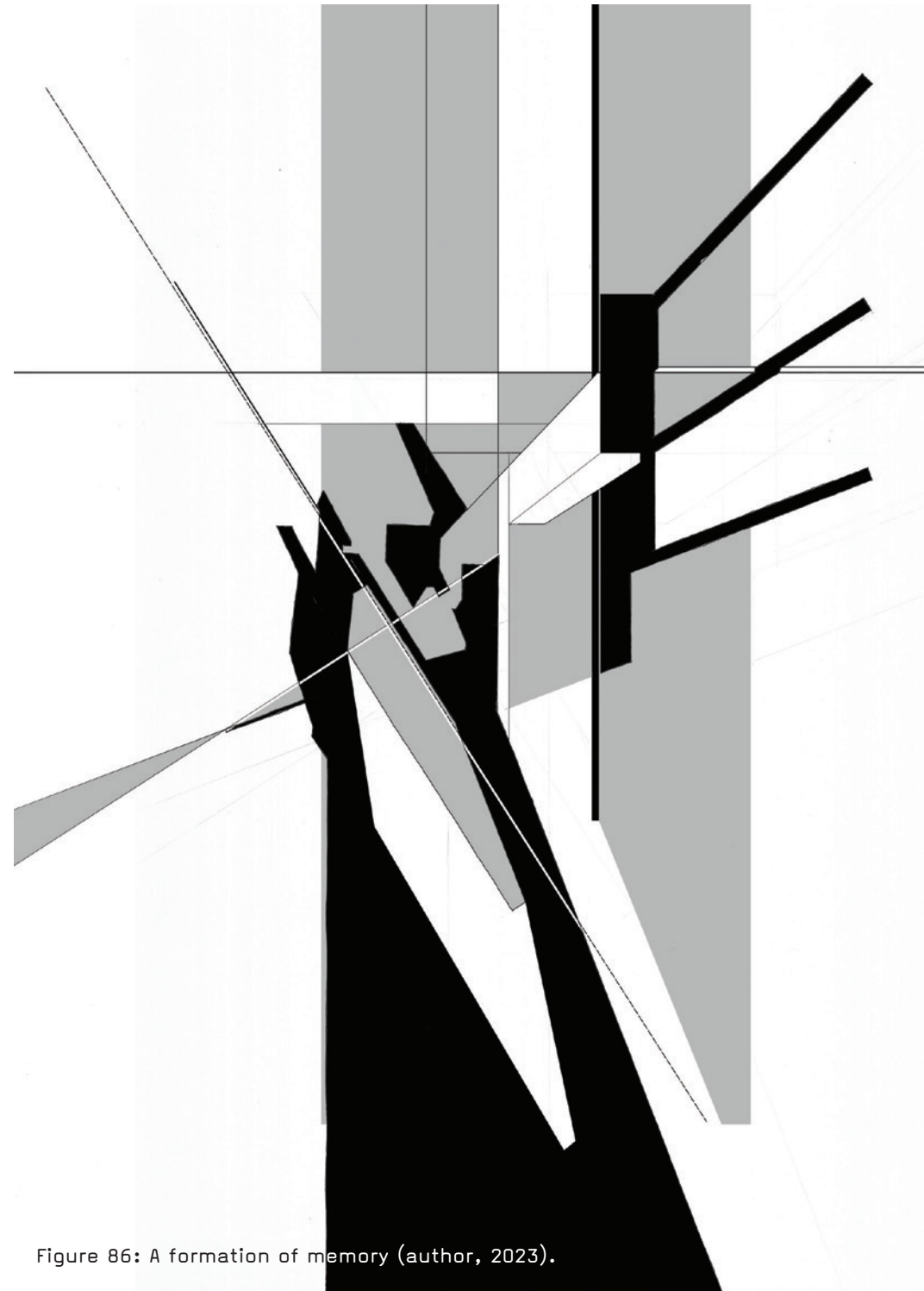


Figure 86: A formation of memory (author, 2023).



Figure 87: Sketch process, remembering the touchstone (author, 2023).

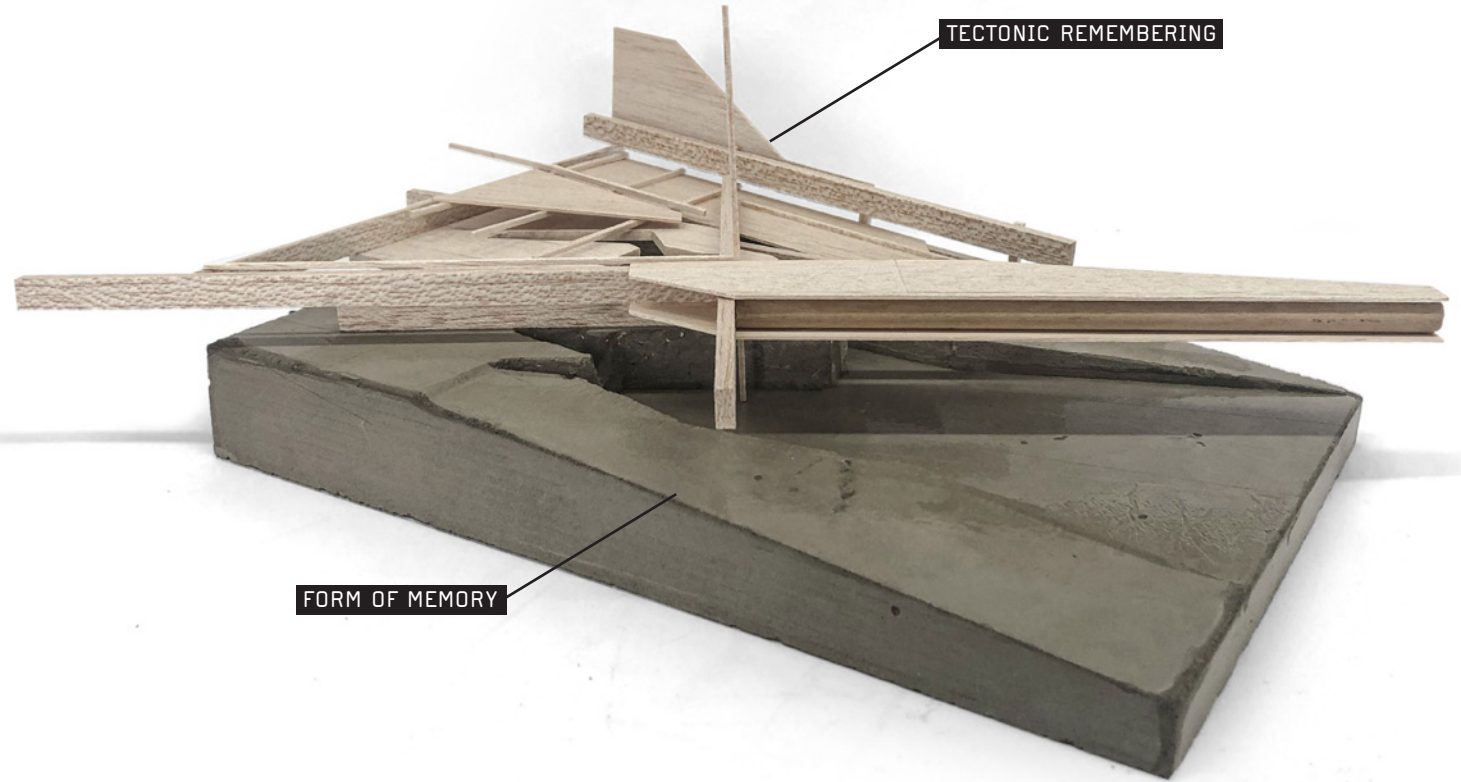


Figure 88: Tectonic expression (author, 2023).

3.6 CONCLUSION

The conceptual work in this chapter (Figures 89-91) demonstrates the significance of anchoring design intentions in site-specific realities and historical contexts. The initial historical analysis serves as a starting point, while the touchstone contributes its form to guide subsequent design concepts. Through explorative sketches and physical models, the diagrams illustrate this dynamic process.

The site and historical significance should always be kept in mind when shaping meaningful forms and creating contextually rooted architectural solutions.

The next chapter asks what lessons can be learnt from the analysis of precedent architecture and how those forms are shaped by their contexts.



Figure 89: Drawing iron curtains (author, 2023).



Figure 90: Remembrance (author, 2023).



Figure 91: Visible machinery (author, 2023).

CHAPTER 04

PRECEDENTS

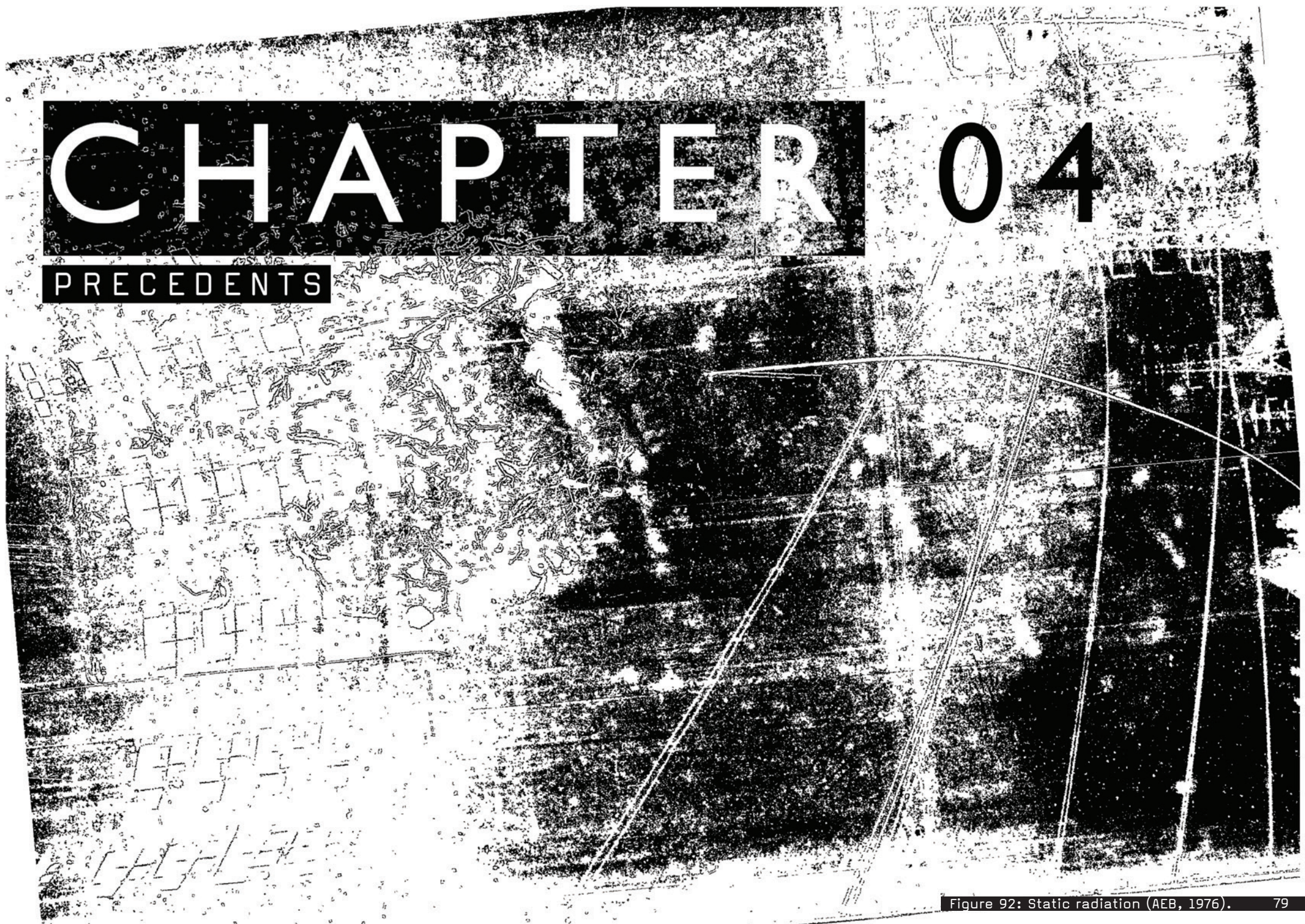


Figure 92: Static radiation (AEB, 1976). 79

4.1 INTRODUCTION

In examining the intersection of architecture, memory and historical context, analysis of how innovative design approaches challenge conventional notions of monuments and memorials can be made. The chosen buildings redefine the traditional understanding of commemoration in their own ways.

Lebanon's B018 project, designed by Bernard Khoury, defies categorization, serving as both a solemn memorial during the day and a vibrant nightclub at night. Günther Domenig's Documentation Centre in Nuremberg disrupts the structure of Nazi monuments, functioning as both a memorial and a cautionary reminder, engaging visitors in a dialogue with history. Lebbeus Woods' "high houses" concept responds to war's devastation, balancing a utopian vision with respect for the historical fabric of ravaged cities. Maya Lin's Vietnam Veterans Memorial challenges expectations, emphasizing the individual while remaining politically neutral.

These architectural projects illustrate how innovative design can reshape our understanding of memory and commemoration, inviting one to engage with history (Figure 93) in thought-provoking ways.



Figure 93: Rubble of Building 5100, the intersection of memory and form, how should structure interact with this? (author, 2023).

4.2 B018

Built in 1998 in Lebanon, the B018 project, designed by Bernard Khoury, serves as a response to the challenging and volatile circumstances deeply ingrained in the historical context of its location (Khoury, 2018: online) along with the inherent contradictions that arise when implementing an entertainment programme in such a site (Figure 94). The project is situated somewhere between the sacred and the profane. It acts as a memorial by day and a dance club and bar at night.

B018 does not seek to disregard the past. The scars of the previous atrocities in the once Palestine refugee camp are still evident in the surrounding urban surface and social activity. The conflict saw an attack on the refugee camp and the loss of many lives. B018 deliberately embraces an underground construction approach, wherein its facade is carefully integrated into the ground to prevent an overwhelming prominence.

There are two levels of integration with the context: its ironic mimicry in the direct quotation of the underground (Figure 95), recessed grave, the realm of the dead, and its metaphorical reinterpretation of human engagement. This contrast is everywhere in the design: red curtains against the rough floor, a mechanical roof above wooden tables and those who come to the nightclub versus those who mourn (Kenzari, 2011: p92).

Although some of the images of the building may come across as 'iconic', for example, the strong circle built around the building, the subtle nature of sinking the building underground begs an appreciation and respect for the context (Figure 96). It is further allowed to address its environment through the opening and closing roofs as well as the large mirrored surface above the bar of the sunken memorial (Figure 97). This allows for a much more solitary and closed place of remembrance during the day but transforms itself by opening up to the night sky.



Figure 94: Carefully digging into the earth to reveal sensitively (Khoury, 2018).

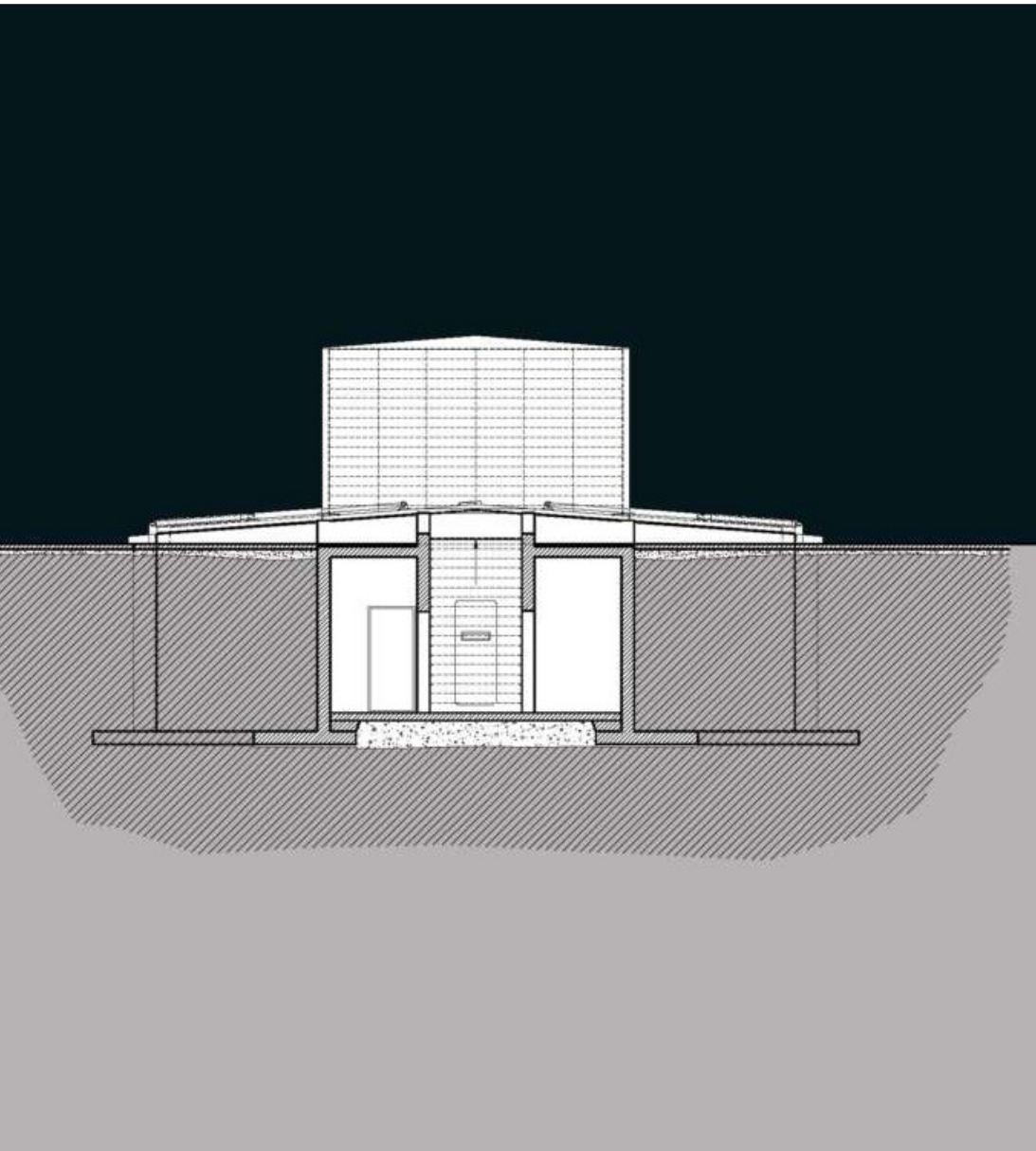


Figure 95: Section showing dug-in structure (Khoury, 2018).

KEY PRINCIPLES:

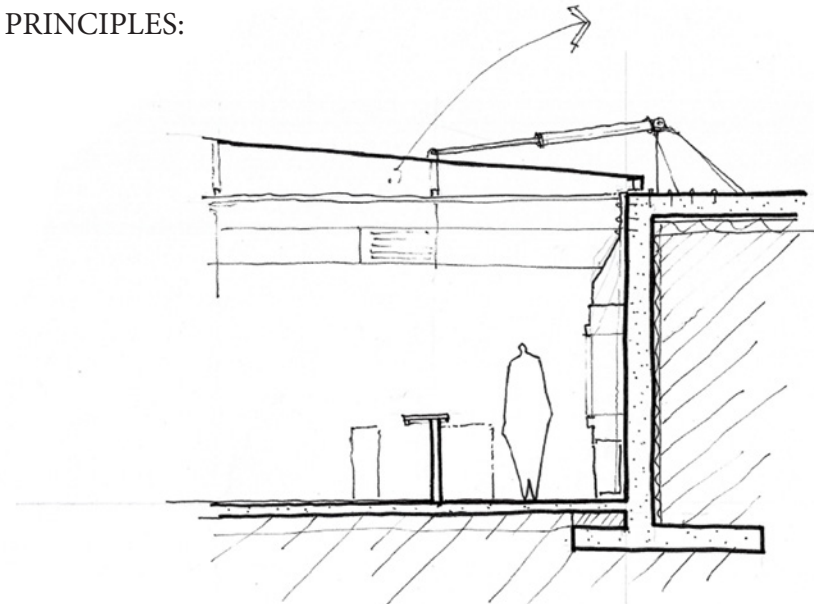


Figure 96: Underground tectonics (author, 2023).

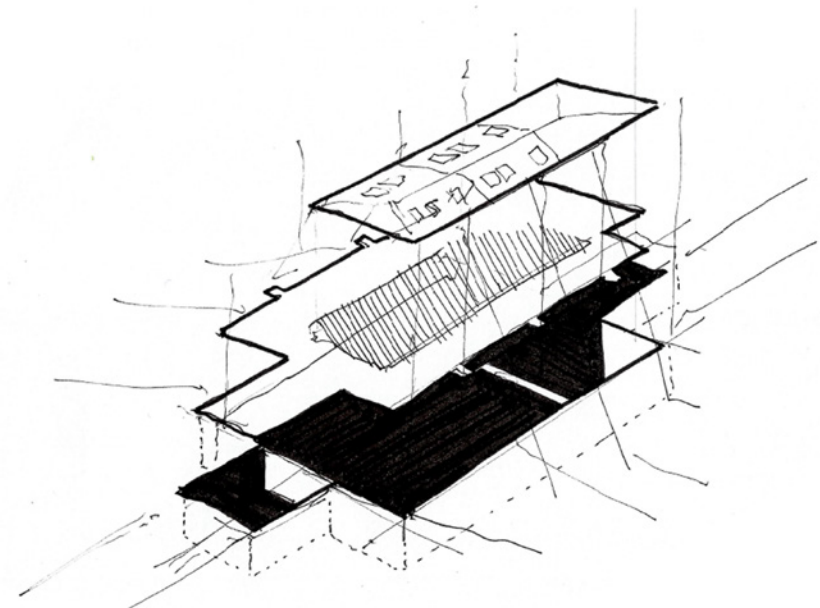


Figure 97: The underground tomb and steel covering (author, 2023).

4.3 DOCUMENTATION CENTRE

The Party Rally Grounds in Nuremberg is one of the largest relics of the Nazi state. Built to house half a million supporters, the structure was used for gatherings from the 1930s onwards (Maurer, 2022: online). Much of the existing building houses the critical elements of the monument, grand gestures meant to produce awe in the visitor and represent the power of those behind it. Now it stands as a memory of what once was, with that memory being challenged by the formation of a new design (Figure 98). Günther Domenig's conception of the Documentation Centre in Nuremberg embodies a dual purpose, serving as both a memorial and a cautionary reminder. In the design, Domenig prioritised the deliberate disruption of the building's conventional axial layout (Figure 99), thereby instigating a counter-conversation to the existing structure and design.

The intention extended beyond the seamless integration of the Documentation Centre into the pre-existing structure to function effectively as a museum. It aims to provoke a meaningful engagement with Nazi architecture and the ideological underpinnings that produced it. It is a fascinating language to respond with architecturally. The new wants to refrain from participating in the notions of the old. The monument-like existing traditional building is treated carefully for its historical significance, yet is countered through the insertion of the spine (Figure 100), almost as if the two structures are at a quiet war with one another.

The new Documentation Centre offers little addition to the floor space yet constructs a completely new experience of the architecture from within the existing (Figure 101), allowing visitors to 'walk through' the overlying axial grid. The end of the path protrudes into the colossal courtyard that lies at the heart of the original rally grounds. This overhanging walkway allows an individual to look into the courtyard off centre of the axis, almost mimicking the idea of how the new centre offers a counter-narrative to the old.



Figure 98: The spine piercing through the historical grid (Maurer, 2022).

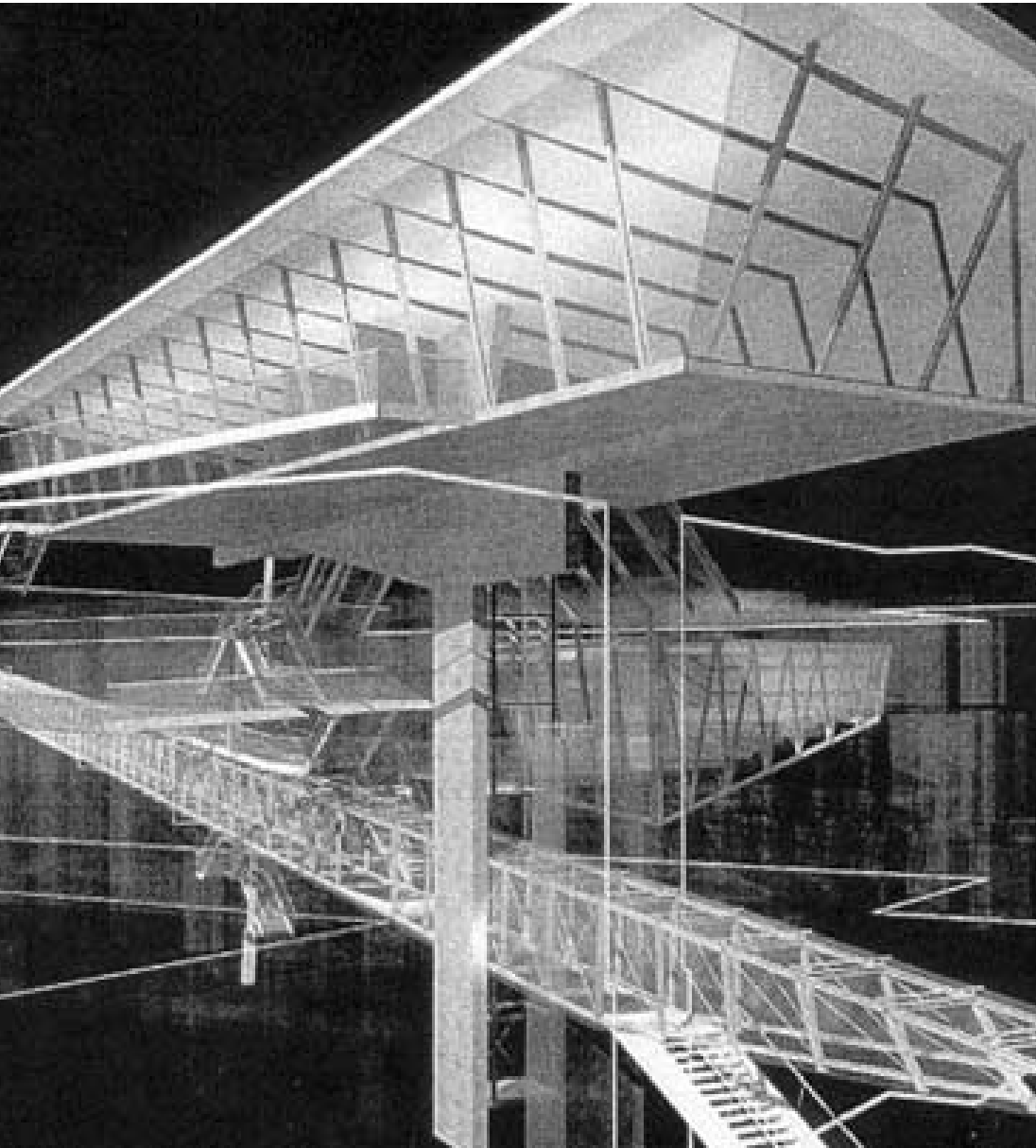


Figure 99: The new morphology (Maurer, 2022).

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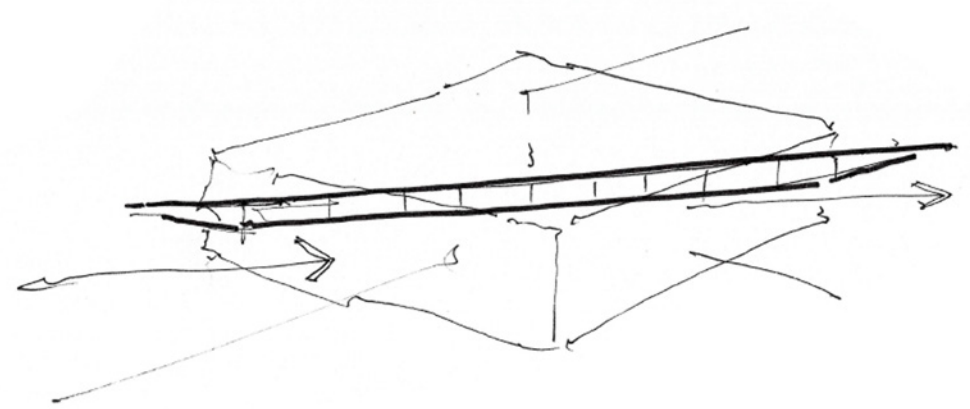


Figure 100: New piercing the old (author, 2023).

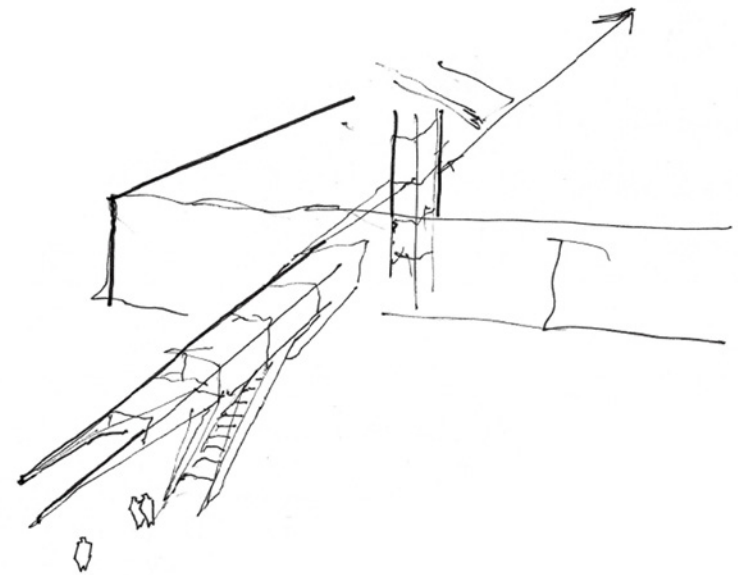


Figure 101: Entrance to the spine (author, 2023).

4.4 HIGH HOUSES

In his work, *War and Architecture*, Lebbeus Woods (2010: online) explores the potential for architecture to respond to environments devastated by war. The violently deconstructed building leaves behind an architectural scar that is of tragic remembrance. The rubble of conflict is a unique reference that marks a landscape, transforming that space as well as the memory of it.

The concept of “high houses,” which emerged in the aftermath of the Siege of Sarajevo, offers ways in which form can respond to the rubble (Figure 102). Through intricate drawings Woods aims to illustrate a twofold relationship with locations ravaged by destructive bombings (Figure 103). These houses, supported by steel cables in a structurally complex manner, embody a paradoxical symbolism. On one hand, they aspire to envision a utopian future, while on the other hand, they endeavour to maintain a profound connection with the historical fabric of the city. By embracing these contrasting elements, the high houses navigate a delicate balance between projecting a forward-looking vision and preserving the historical legacy of the urban landscape.

The steel connections that link to the ruined respect the scattered pieces of the ruin. The conceptual approach of safeguarding the individuals dwelling high above the destroyed landscape is a way of reallocating the non-liveable space into place (Figures 104 and 105). The human can dwell in the high house, but the harsh impact of the ruin is respected as a tomb of what once was. The high houses are a kind of memorial of the buried but again for the living in a paradoxical relationship.

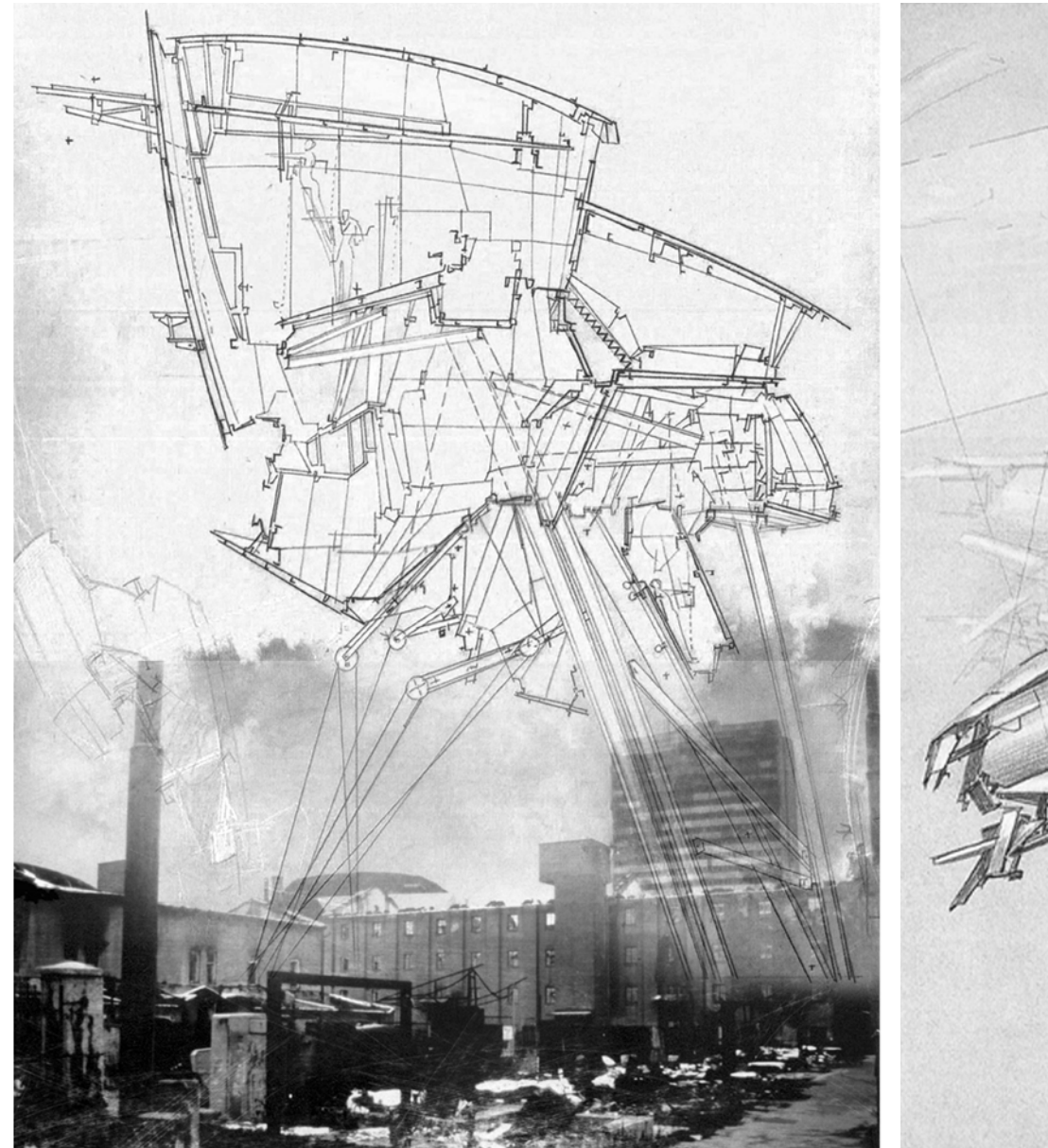


Figure 102: Architecture attaching to the ruins of warfare (Woods, 2010).

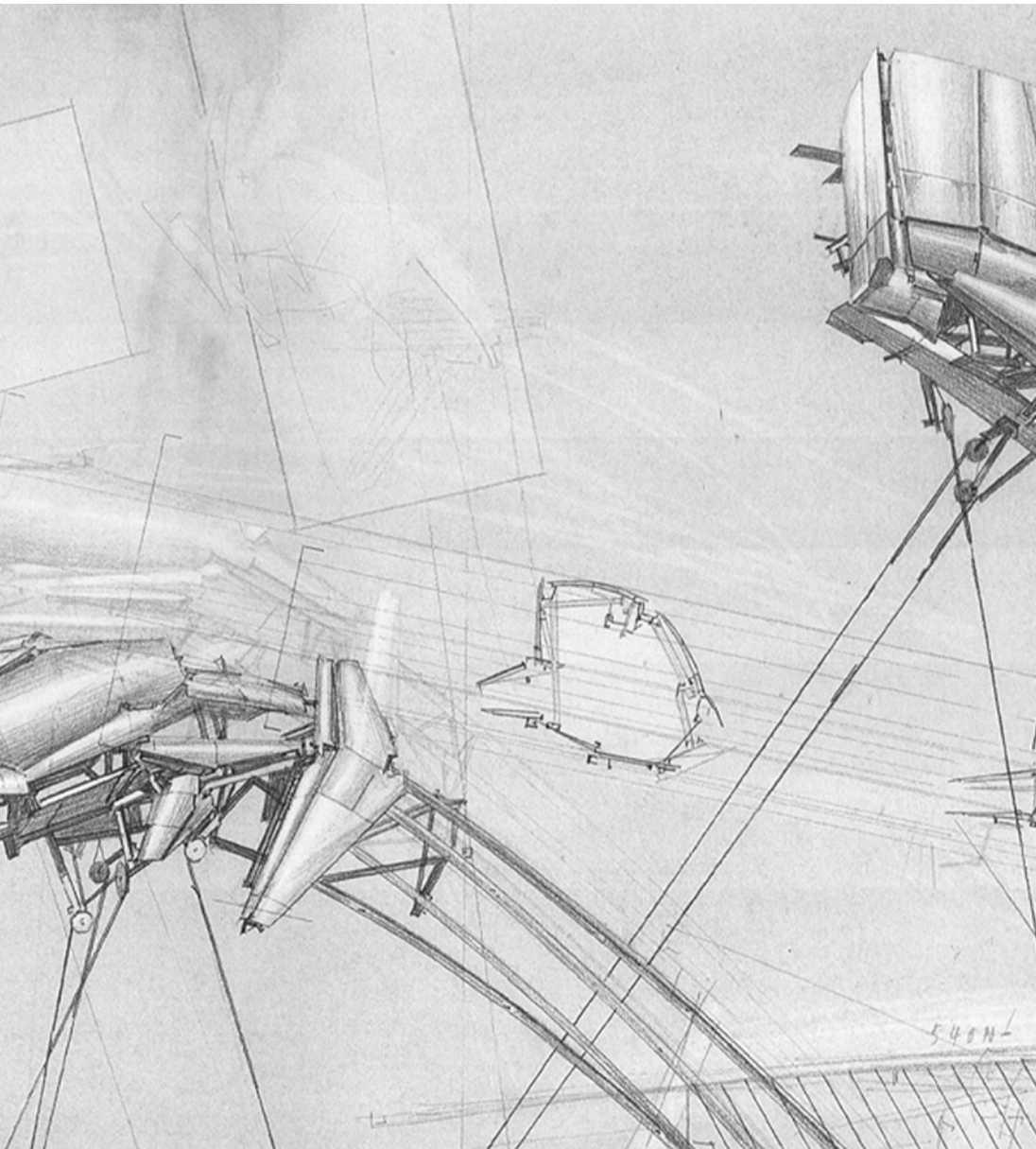


Figure 103: Hovering forms of structure (Woods, 2010).

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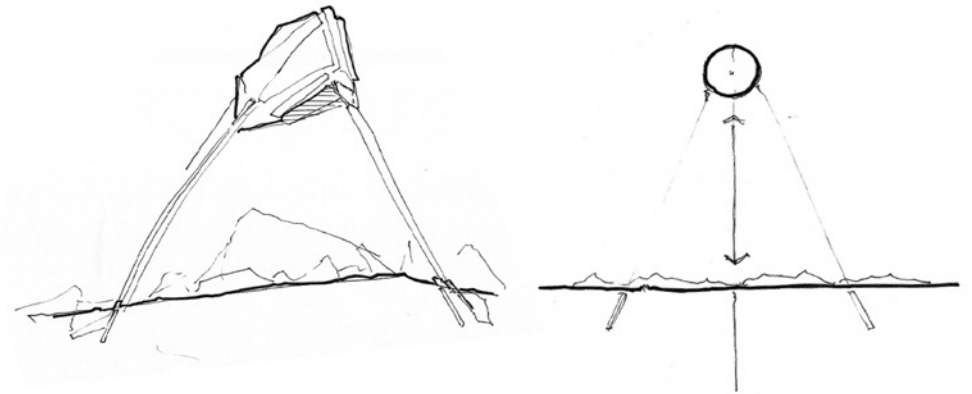


Figure 104: Touching the ruin lightly (author, 2023).

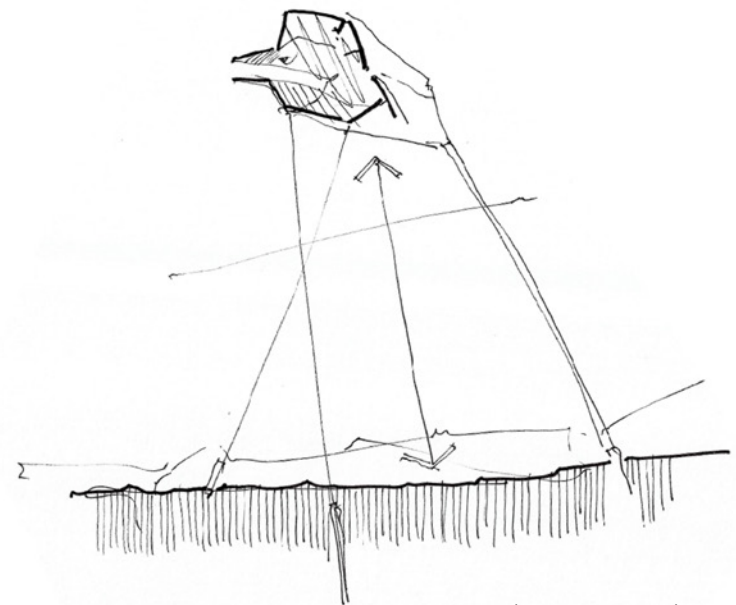


Figure 105: The separation of space over ruins (author, 2023).

4.5 VIETNAM VETERANS MEMORIAL

The Vietnam Veterans Memorial was a competition design entered in 1981 by Maya Lin. It is located between the Washington Monument and the Lincoln Memorial and stands as tribute to the more than 58,000 American soldiers who died in the Vietnam War (Adams, 2023: online). The memorial's design incorporates two descending linear cuts, flanked by black granite panels inscribed with the soldiers' names arranged chronologically according to their dates of death (Figure 106). By utilizing reflective black granite, the design accentuates the names against the mirror of the visitor.

The design is meant as a homage to the sacrifices of the individuals whose names inscribe the memorial and allows for a physical place to take the formation of memory. Notably, Lin sought to conceive an abstract and apolitical monument that would underscore the notion of individual sacrifice (Adams, 2023: online). However, due to the contentious nature of the Vietnam War, the project was still fraught with controversy.

While the memorial is commonly referred to as a "wall," Lin envisioned it as an "edge in the earth," representing an initial act of violence and pain that ultimately transforms into a process of healing and commemoration (Adams, 2023) (Figure 107). This concept seeks to profoundly honour the fallen soldiers and collectively memorialize their sacrifices in the nation's consciousness.

This is a fascinating example of a monument that is taking the traditional attributes of such structures and forming something new, allowing for memory to be triggered rather than to be dictated or designed. The power of this memorial is in its simplicity, the stark line rising from the earth (Figure 108) and the reflective sides (Figure 109) are intriguing even to the average passer-by. The abstract condition of the monument is balanced by the specific detail of the names counted on the wall.



Figure 106: An abstract monument, a different way of remembering (Adams, 2023).



Figure 107: Remembrance (Adams, 2023).

KEY PRINCIPLES:

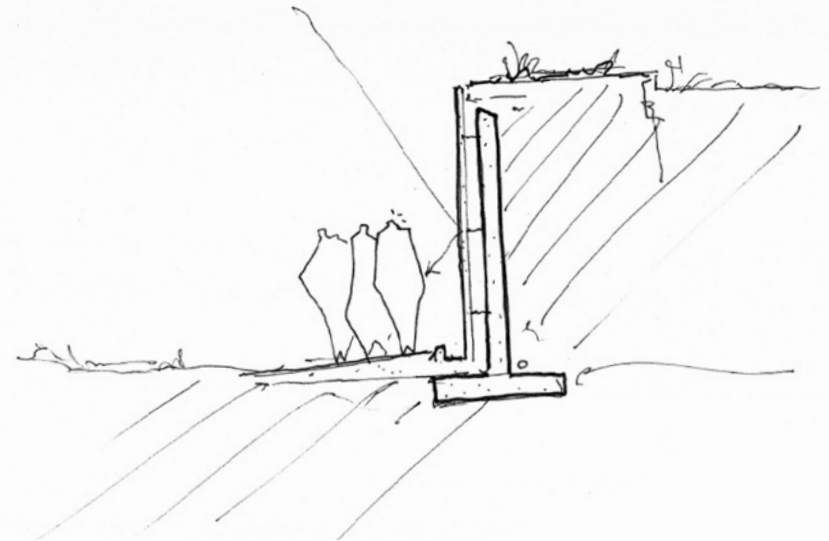


Figure 108: Rising from the earth (author, 2023).

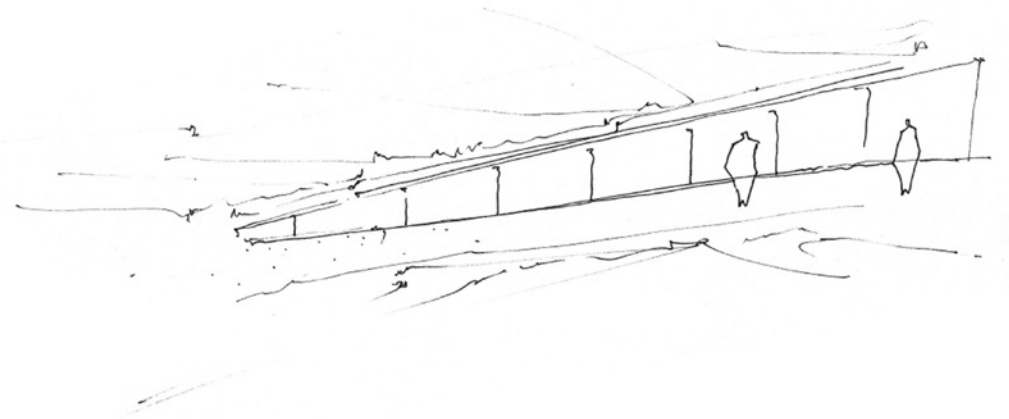


Figure 109: A scar in the landscape (author, 2023).

4.6 CONCLUSION

In conclusion, these architectural projects stand as meaningful responses to challenging historical contexts, offering unique perspectives on memory and memorialisation. In all of these examples the architecture is responding to heavy topics. Each demonstrates something different as a lesson to take away.

B018 exemplifies the delicate balance between the sacred and the profane. It serves as both a memorial during the day and a nightclub by night, acknowledging the scars of past atrocities while respecting its surroundings. This dual nature challenges conventional notions of remembrance.

The Documentation Centre in Nuremberg disrupts the traditional Nazi monument and serves as both a memorial and a cautionary reminder. By engaging with ‘Nazi architecture’ and ideology it creates a counter-narrative within the existing structure, fostering meaningful dialogue about the past.

“High houses”, born from the ruins of war, navigates the complex relationship between projecting a utopian future and preserving the historical legacy of a devastated city. These houses symbolize a paradoxical coexistence of hope and respect for the past.

The Vietnam Veterans Memorial, often referred to as a “wall,” redefines the traditional monument. It embodies an initial act of violence and pain transformed into healing and commemoration through a scar-like structure in the landscape that allows for families to remember those they lost.

The precedents are all taking elements of the typical monument or memorial and defining them in new and interesting ways (Figures 110-112). The way in which architecture engages with the past cannot ever be set in a single set of rules and always depends on the context of the scenario. The monument does not encapsulate everything there is to offer in the form of remembrance. The next chapter explores the possibilities beyond the monument.

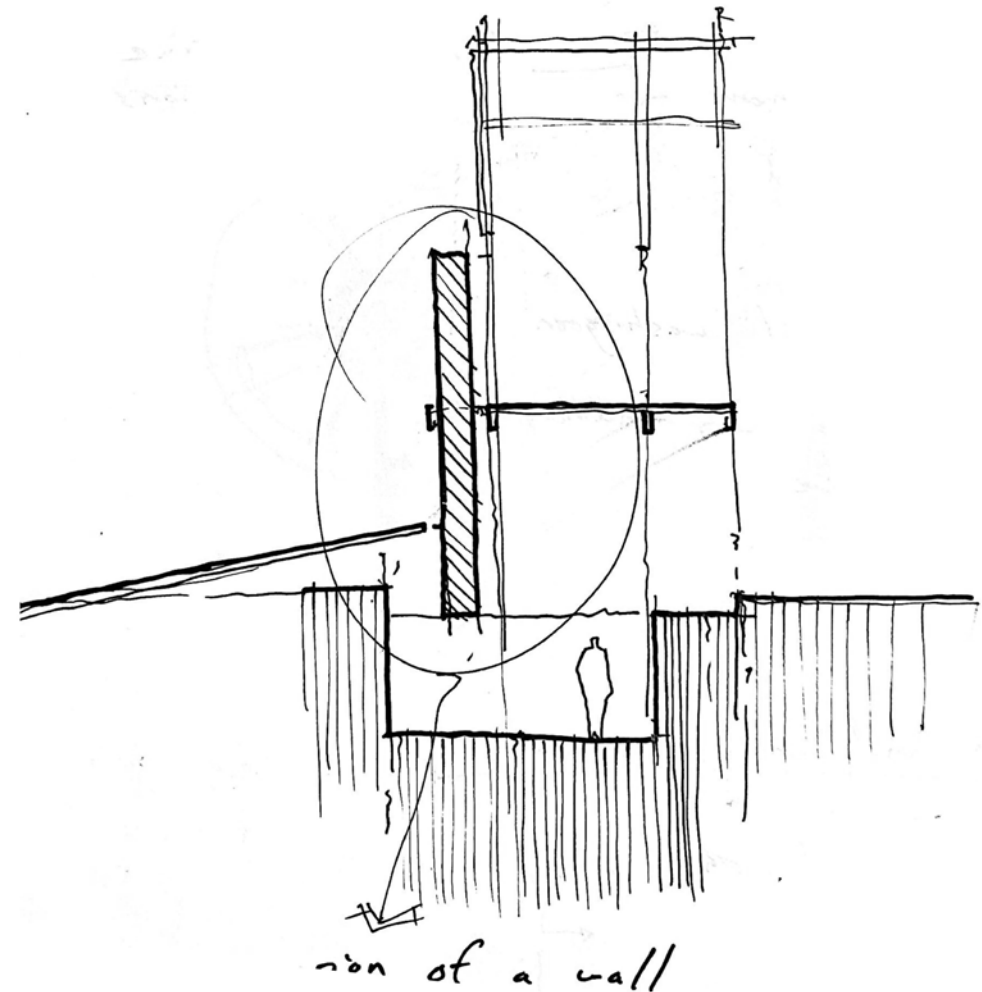


Figure 110: Reshaping of a wall (author, 2023).

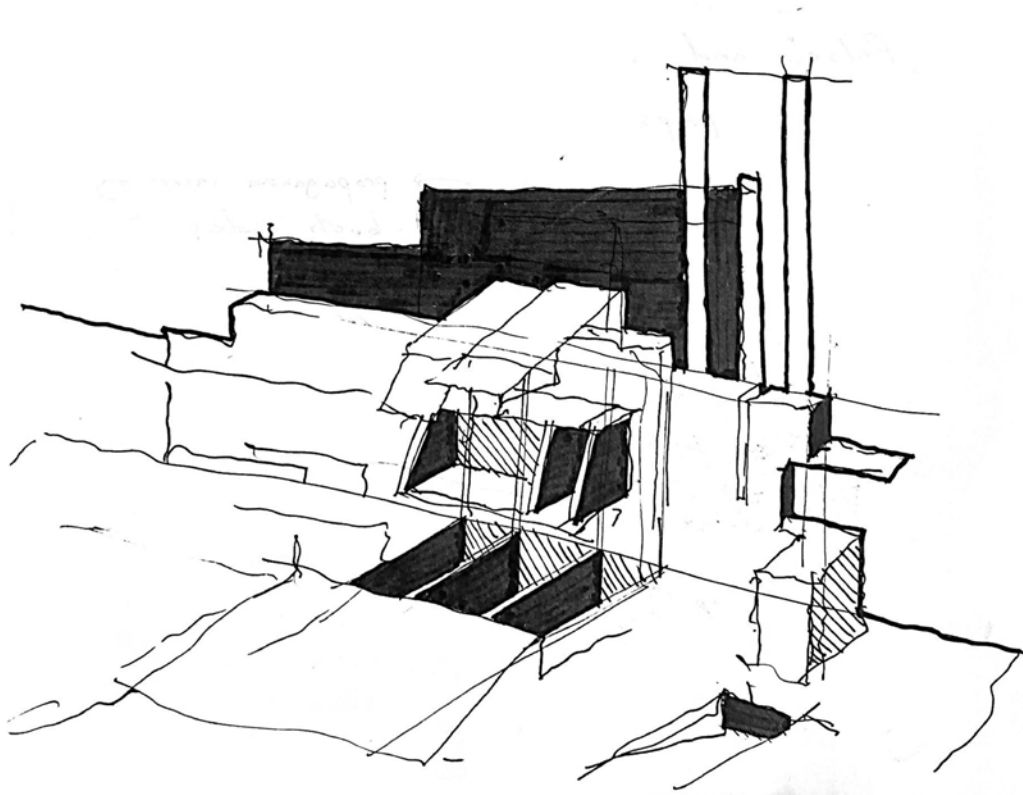


Figure 111: Walls rising from the earth (author, 2023).

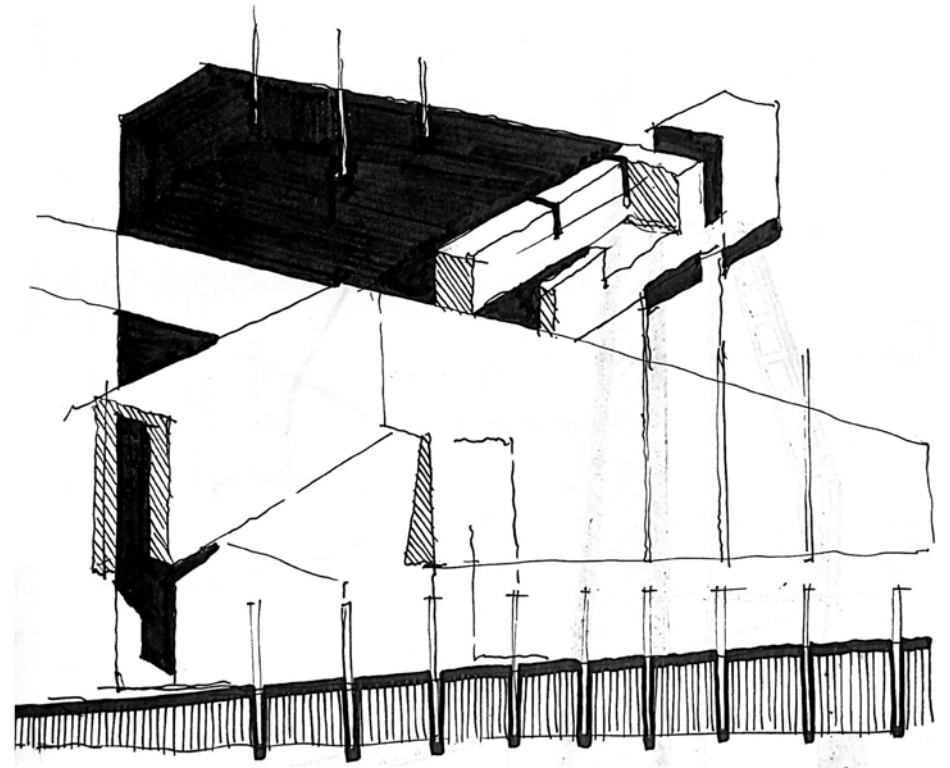


Figure 112: Deconstruction of a wall's characteristics (author, 2023).

The vertical beam tube in position in SAFARI-1.

CHAPTER 05

THEORETICAL REACTION



Figure 113: The reactor pool (AEB, 1976).

5.1 INTRODUCTION

Architecture has been a response to the external since its inception — walls to protect, a roof to shelter. In some ways architecture has been shaped by conflict and the threat of it. That is not to say that this is its only response, of course. It responds in many other ways, but the built form can, and often does, respond to conflict in function and morphology. In some instances it may be shaped by it, or rather unshaped. Left in the forms of rubble, what do these memories of violence hold for the individual who sees them?

A structure can be weaponised by a voice from either side in warfare. Grand buildings project authority and can dominate their place. Buildings can be quiet in their response or even mediate between languages. They can be seen as political symbols and project a cultural sense of pride. So, what happens when a building is targeted for destruction due to its cultural significance? Is the intention to destroy the structure itself or does the rubble left behind become the symbol of the opposition?

As much as a building can respond to conflict around it, becoming a defensible space to protect and shelter, does not war shape buildings, no matter what scale, to become a sign to fester in the minds of those afflicted? Architecture can manifest a psychological shape. The rubble of a building might become just as significant as the built structure (Figure 114).

The perception of such spaces is unique to the creator of it. The same applies to memory. Memory is not history. The understanding of one is not the same as another, even of the same events. This is what is so difficult about the memory of those who lived through conflict. It is an experience that cannot fully be shared from one to the other. Those who have lived through it gain a type of experiential knowledge akin to ‘sublime revelation’ (Baines, 2014: 23). It is the becoming of a flesh-witness.

An essential distinction exists between a flesh-witness and an eye-witness. The acquisition of knowledge through eye-witnessing and observation is characterized by its factual nature and relative ease of transmission to others (Baines, 2014: 24). Conversely, a flesh-witness encounters an inherent limitation

in conveying their experiences to others. They face the challenge of articulating their observations, while the audience is left disjointed from the experience.

However, while eye-witnesses can only gain access to a partial account of events, during acts of war there is usually another seemingly passive accomplice that sheds light on a different aspect of the engagement, namely the machinery of war. Through the lens of post phenomenology it can be understood how the flesh-witness is changed in his experience and how it applies to the holding of machinery.



Figure 114: Weaponised structure (Venter, 2019).

5.2 THE INVERTED MONUMENT

Traditionally, the monument has been a land-anchored permanence that stands in time, impervious to change and opinion. Monuments are intended as everlasting witnesses to future generations so that a specific event or people may be remembered (Young, 1993: 3). They are often structured as a central point of recollection of an exact narrative to be recalled. Monuments remain essentially celebratory markers of triumphs or individuals, praising the state that has resurrected them, standing as a marker to all for collective memory. Parallel is the memorial, there to recall the past tragic events. It becomes a place to mourn for those who have lost and to inform others so they may not forget or repeat the same mistakes.

Monuments commemorate that which was, and memorials mark that which has ended. Indeed, points of marked memory blur the lines between these structures: the monument that serves as a place to mourn and the memorial that has become something other than what was built. Often a place can become something other than it was intended to be, remembered differently in a particular context and time. Meanings shift. A monument to one ideology can take form by the recollection of those in awe of it in an entirely different context—memory and remembrance of complex endeavours of the human. If the land-anchor serves to mark and pull the body in one direction of thought, it may not be the thought intended. One does not have the same recollection as the other, yet events exist in one truth, but that truth is only sometimes understood through one narrative. So, do the memorial and the monument provide enough expressive room for the memory of events that are so conflicted? If ‘pure recollection’ is fiction, can remembrance be recalled in more responsible and appropriate ways in places rescripted by more encompassing narratives or ideas?

Often a memorial ‘monumentizes’ itself to remember the grand gestures of an ideology, the soldier standing guard with his rifle or the proud statue with a solemn gaze. It is not to say that these do not have their place, but do these provide the space for people to remember honestly, and that remembrance being something that is not of a grand narrative or specific memorialisation?

The memorial is a significant marker in a society’s reconstruction of the past. Often the creation of a memorial can serve as a narrative of the ruling party at the time and so become part of the official history of that time. While this has many repercussions, especially for later generations, it can serve to erase history through omission.

Something must exist between the land anchor and the standing statue. The inversion of a land anchor may offer some semblance to recall things in an unscripted narrative. If the typical attributes that we consider and associate with the traditional monument can be reversed, it may serve to better solidify a place of unscripted, or less scripted, remembrance. The centralisation of a monument and ‘drawing together’ of ideas to a focal point is what is meant to be avoided. If the inverted monument can stand as a disassembled monument more permeable to the mind of the inhabitant, it might achieve this. The statue is pre-formed, waiting to be beholden, the mould awaits the molten to be cast into it. An architecture striving much more for the mould rather than the cast is the inverted monument.

5.2.1 BORDER WAR

“It often happens that a shooting war is – either immediately or after a while – followed by a second war. This is not fought with bullets or artillery shells, not with tanks or bombers, but rather with words. The war is, in effect, fought again on paper.” (Scholtz, 2020: 1)

Between 1967 and 1992 approximately 600 000 young white males, the majority being near the age of eighteen, were conscripted into the South African Defence Force (SADF) (Baines, 2014: 189). This is not to say that all SADF members were white, many of the troops on the border were black and it would negate their experience to not mention that. Thousands of South Africans, as well as many more thousands of Angolan and Cuban troops, died during this decades-long war. The memory of the Border War, which many of these conscripts fought in, is a source of conflict itself, becoming the conflict that rages on in the pages and hearts of those left behind to tell the tale. The contested memory is a topic bound to draw lines between individuals, depending on their personal stance and relationship to the conflict, and discussions of such memory should be handled carefully. The point of this thesis is not to pick sides but rather to acknowledge the gap that exists between the two sides in terms of the remembrance and obscurances of it.

Ex-conscripts should not be forced to speak with a single or homogeneous voice. The experience of fighting in the war is remembered differently and uniquely by every conscript. The feelings of those conscripted vary greatly depending on the background and beliefs of the individual. Additionally, this war saw the collaboration of men from Afrikaans, English and more traditional African cultures. The conscription campaign brought about the combination of people with many different, even competing world views, and finding a conglomerated voice to speak for them, even today, is not defensible. Consider, for instance, Freedom Park as an example from current memory.

Freedom Park was erected to honour all who died during the conflicts that shaped today’s South Africa, the ones who have been killed in combats in South Africa’s past liberation struggles over many years. A controversy occurred when

a decision was made to omit the names of the deceased SADF soldiers from the Wall of Names at the park (Baines, 2014: p188) (Figure 115). One side saw the addition of these names as memorialising those who gave their lives protecting South Africa from a communist war in Angola, while the opposing voices saw this as adding the names of those who had fought to preserve apartheid. To exacerbate the situation, the names of Cuban Soldiers who died between 1975 and 1988 are inscribed along the walls at Freedom Park, and as recently as March 2023 saw a ceremony hosting Russian and Cuban delegates at the park (DSAC, 2023: online).

According to Gary Baines (2014: 196), who in many regards is politically opposed to Scholtz, the decision to omit SADF names from the Wall of Names at Freedom Park was felt as ‘rubbing salt in the wounds’ and a failure to acknowledge the contribution of those soldiers to the making of the new South Africa. The response to this was for some SADF veterans to build a new remembrance wall near the Freedom Park site. The outcome of these events has had the effect of further dividing people on the memory of the past. Where the point of this memorial is to bring reconciliation and a space to remember the “pain and victories of the past” (2014: 196) it has served to divide groups further. This battle to control the narrative from both sides leaves little space for individuals to process the memory that is so unique to each person. The more we create, the more scripted. The more that is designed for specific remembrance, the more dictated. What is referenced here does not concern the quantity built. Instead, one can agree that the level of specificity with which a memorial concretises events, a situation exacerbated by a lack of vagueness, might merely be beholden to the state’s view at the time of formation.

There is a risk of forgetting (or one-sided remembering) when collective and national memory is formed by the state, which often chooses to form a historical narrative of recollection without considering the experience of all those involved. All the events of the past have brought about the South Africa we are in today and national unity can only really be ‘true’ when founded on an understanding encompassing all these events that contributed to it.



Figure 115: Freedom Park's wall of names (Baines, 2014).

There exist now three memorial walls in close proximity to each other, yet they are separated by their borders: one in Freedom Park and two separately dedicated to SADF soldiers near the Voortrekker Monument and Fort Klapperkop. These separate memorials are a sure sign that the construction of a consensual past remains elusive to the South African psyche. However, disputed sites do offer a platform for public negotiation and discussion. Who is to say that the differences in experience are a terrible thing? Are our differences preventing us from nation-building, or are these contrasts a deep part of our nation as a place that allows South Africa to be robustly democratic? Is it to say that we do not necessarily need to create one narrative or correct version of history for all to bow to in a singular monument? Is it possible for two things to exist in conversation even when not agreeing?

Ultimately, it seems clear that the complete separation of memory and places to mourn is not constructive to healing rifts between people who are already separated in memory. Therefore, somewhere between the inclusive and the exclusive memorial could exist something to promote nation-building. This is the creative space in which the inverted memorial can thrive: a place where conflicting memories can be remembered within the context of the same page; a structure neither of narrative nor national history but rather something that speaks more to the remembrance and recollection of all those afflicted by the Border War.

5.2.2 A LOOK AT WHAT REMAINS

The monuments and memorialised spaces that remain for those who fought in the Border War have similarities and respective differences on each side. The wall of deceased names is a prominent factor in both memorials and the statue of the soldier too. These are significant principles that most memorials and monuments present. Although neither of these are the only memorialised spaces for the Border War, they are prominent and the following section will discuss five monuments from South Africa, Namibia and Angola.

The Cuito Cuanavale memorial (Figure 116), built in Angola, is a memorial and monument to commemorate those who died in the battle of Cuito Cuanavale. The memorial grounds house several structures: a sculpture wall of soldiers in combat, a statue of the Angolan flag wrapped around a rifle, a statue of two soldiers holding an emblem and a memorial building (Figure 117). The large statues emanate the typical qualities of a state monument, the triumphant soldier standing proudly holding up an image of the country. The image of the AK-47 is prominent in all of the sculptures and the role this weapon played in the war clear through its symbolism. It is an interesting observation of how iconic this image is and an acknowledgement of how much machines are a part of organised conflict. The combination of the soldier and his rifle seems almost as if it they are a part of one another. Maybe the machine is not merely a weapon but has the capacity to recast the soldier as a form of mechanised equipment.

These structures are precisely what entails the blueprint of a monument. It is a symbol of victory by the state, staking a claim, and leaves a marker of what once was, as well as becoming a memorial for those who died in the battle it represents. It is a symbol of an ideology as much as a representation of the memory of the fallen. The firearm's grand images and iconic references further drive this home to be a monument more than a memorial.



Figure 116: Grandness of state (Silva, 2022).



Figure 117: The Cuito Cuanavale memorial (Silva, 2022).



Figure 118: Fort Klapperkop statue (Baines, 2014).



Figure 119: The wall of names for SADF (Baines, 2014).

Concurrently, the two SADF memorials in South Africa have similar traits to the memorial ground in Angola. The Fort Klapperkop Statue was erected in 1979 and includes a statue of a soldier in mid-stride and a wall of names of deceased soldiers in South African history (Figure 118). The much more recent SADF Memorial Wall of names is built nearby and lists all those who died in active duty (meaning military actions) and accidents of the SADF as well as a triangular smaller monument.

The Fort Klapperkop statue is typical of a war monument with the soldier holding his rifle, ready or mid-combat, and is meant to inspire memory of his heroic deeds. Just like the iconic imagery of the AK-47, the soldier holds the R1 rifle, the firearm designed in response and used widely to combat the AK-47. This further symbolises the soldier being a part of a machine or becoming one himself. The statue is an interesting parallel to the Angolan monument.

The newer SADF Memorial wall of names monument, unveiled in 2009, comprises a semi-circular wall encompassing the triangular monument (Figure 119). This was the memorial built in response to the rejection of the inclusion of SADF soldiers' names at Freedom Park. The 'triangular monument' is a pentagonal shape that comes to a point, bearing the inscription "In Honour of the Unknown Soldier". Just as Freedom Park's Wall of Names is an unfinished project by the continual addition of names, the SADF memorial wall continues to see additions to the list of casualties inscribed on the stone.

The Heroes' Acre Memorial (Figure 120) constructed in the landscape ten kilometres south of Windhoek differs slightly from the other examples mentioned here as it additionally serves as a burial ground for national heroes. It presents itself as to “maintain patriotism and national consciousness and pass on the legacy to future generations of Namibia” (Weidlich, 2020: online). Much of the construction of the memorial falls into the typical monumentality of ‘state gestures’. The enormous scale and setting up of the statue through glorious axis lines situate the viewer to see the iconic imagery in a certain light. A personal witness to this kind of greatness is surely pushed to a subtle awareness of a smallness of person in relation to such a large ideological statement. Some might identify with that statement, which could lead to the feeling of being drawn into ‘something greater’, but memory should not only be left to these grand gestures.

The Eenhana Shrine (Figure 121) is an instructive symbol of remembrance dedicated to honouring the fallen freedom fighters who sacrificed their lives during the Border War. Its construction was prompted by the discovery of a mass grave near the Angola-Namibia border. The shrine features a prominent statue depicting a female combatant from the People's Liberation Army of Namibia (PLAN) holding a flag with unwavering resolve. This memorial marks a significant cultural shift in Namibia's collective memory, shifting the focus from larger ideas and exiled Figures honoured at the Acre Memorial to recognising the contributions of ordinary civilians in the conflict. The Eenhana Shrine aims to emphasise the multifaceted impact of the war on Namibian society and foster a deeper appreciation for the loss displayed by both combatants and civilians alike. However, as an expression of state remembrance, the memorial is just another example of ‘monumentalising’ the memory associated with the Border War.

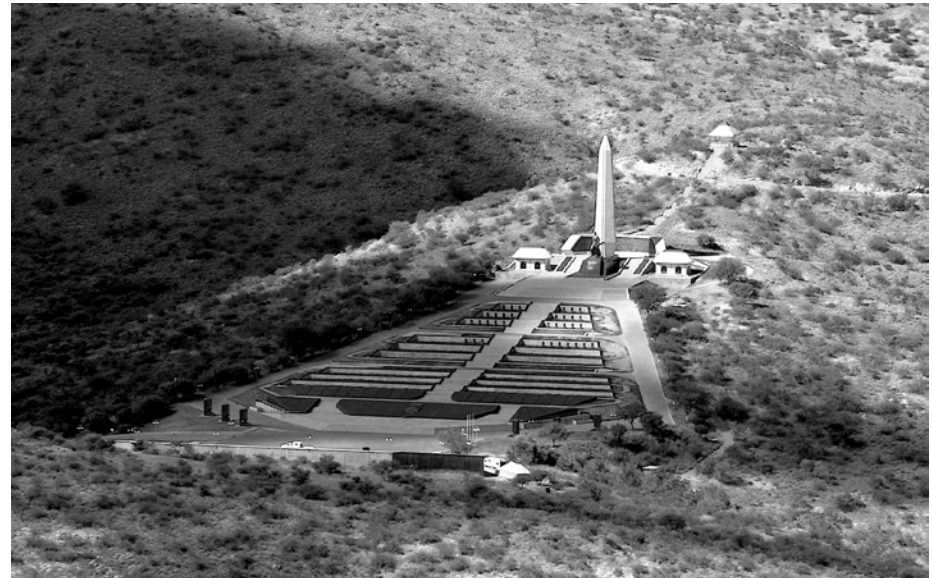


Figure 120: Heroes' Acre Memorial (Weidlich, 2020).



Figure 121: The Eenhana Shrine (Baines, 2014).

As in all of these studies, the frame of reference of this document is to observe how the remembrance of the Border War is situated in the built form across the different territories of the conflict. What are the built memories that remain? Even though they are each backed by separate entities of separate ideologies, they speak in a very similar architectural language. The statue of the soldier is known the world over as the representation of those who lost and gave up their lives for a cause greater than themselves. They are surrounded with what one could almost describe as a religious aura. This analysis of these memorials is not to say that they should not exist nor that they do not have their place. It is rather the observation of what is lacking in their approach to remembrance.

Memorials lose their significance and meaning when past wars and events are forgotten. The current state of memory surrounding the Border War is in decay and conflict. The battle for an ideological memory to be concretised has continued to this day. There is no consensus on who won the war nor who should be 'allowed to be remembered' for the blood they shed. These structures must not become unrecalled monuments to the undeclared war of words between sides. The separation of memories and battle over memorials, as seen in the Freedom Park example, is the prime condition in which to insert the inverted monument, something which is not specific and draws to an exact point of defined recollection, but rather something that can be a space, or rather a place, of remembrance for all those afflicted by the war and for all of us to not forget.

5.3 DARK TECTONICS

Although, technically, South Africa was at peace during the Border War, the government was waging a seemingly endless counter-insurgency, which damaged many lives. The Post-World War 2 reality saw an end to the manually operated or single-shot military rifle. Self-loading weapons that feed automatically were the future of weapon design. Around the world designs were produced to fill the technological gap that had formed, and competitors had to keep up. The Soviet Union was quick to develop a simple, reliable weapon that could be deployed all over the world to a variety of armies (Cashner, 2013). The AK-47 became that weapon. Its influence and form are associated with many conflicts and it is still used today.

The West needed to develop an answer to the AK-47. Over a long period of conceptual work, the FN FAL was produced and fared the best (Cashner, 2013). Although referred to as an assault rifle, its true technical name is a main battle rifle or MBR for short. It became one of the most iconic rifles during the Cold War era and was deployed in over 90 different nations. Hence it was given the nickname ‘The Right Arm Of The Free World’ (Cashner, 2013).

The FN FAL, better known as the R1 rifle in South Africa, was the standard issued firearm for South Africa from the 1960s onwards until replaced by improved versions. The rifle was adopted by the South African Defence Force (SADF) during the Border War and deployed all over the country (Cashner, 2013). The name and style of the weapon is an iconic machine from that era. Of course, the weapon saw variants over time and ‘descendent’ designs of the R1, the R2 and R3, have been deployed as time progressed and designs developed.

The weapon’s shape and form is intimately known by those who were conscripted (Figure 122). Weapon drills are common in all militaries, where an individual must quickly disassemble and reassemble a firearm to prove his knowledge and skills. The exercise serves to teach the soldier how a particular firearm functions and then that individual will be able to maintain and service their weapon. The seconds in which one could take apart and put back together the machine are compared to the seconds upon which one’s life may rest. This is a ritual of mechanism that reflects the nature of machine quality whereon the soldier’s own life exists.

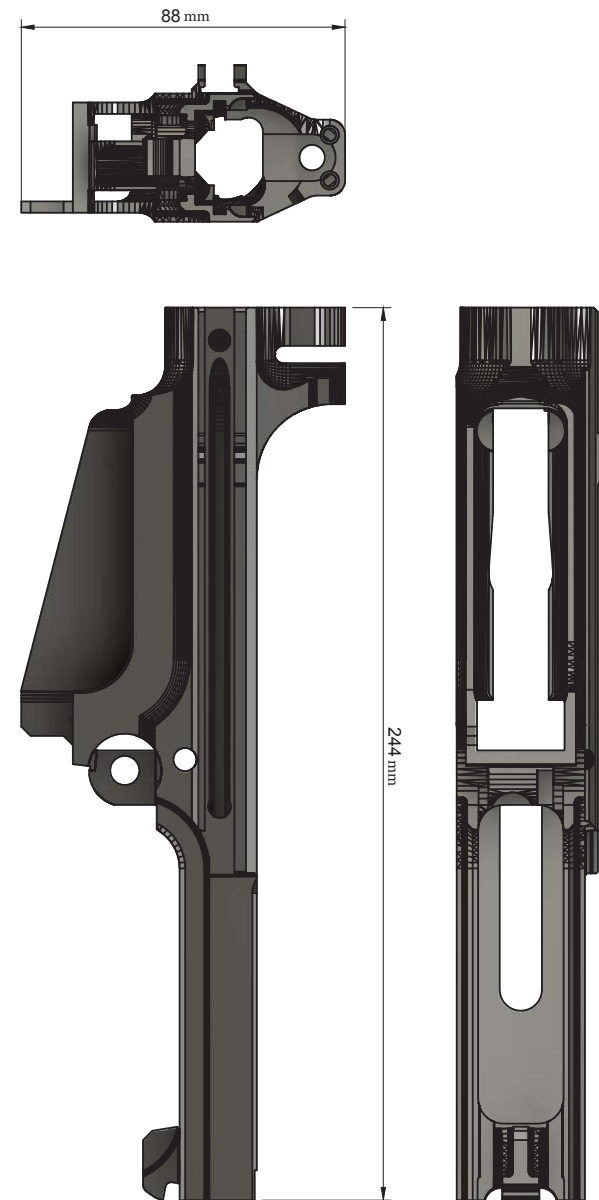


Figure 122: The receiver (author, 2023).

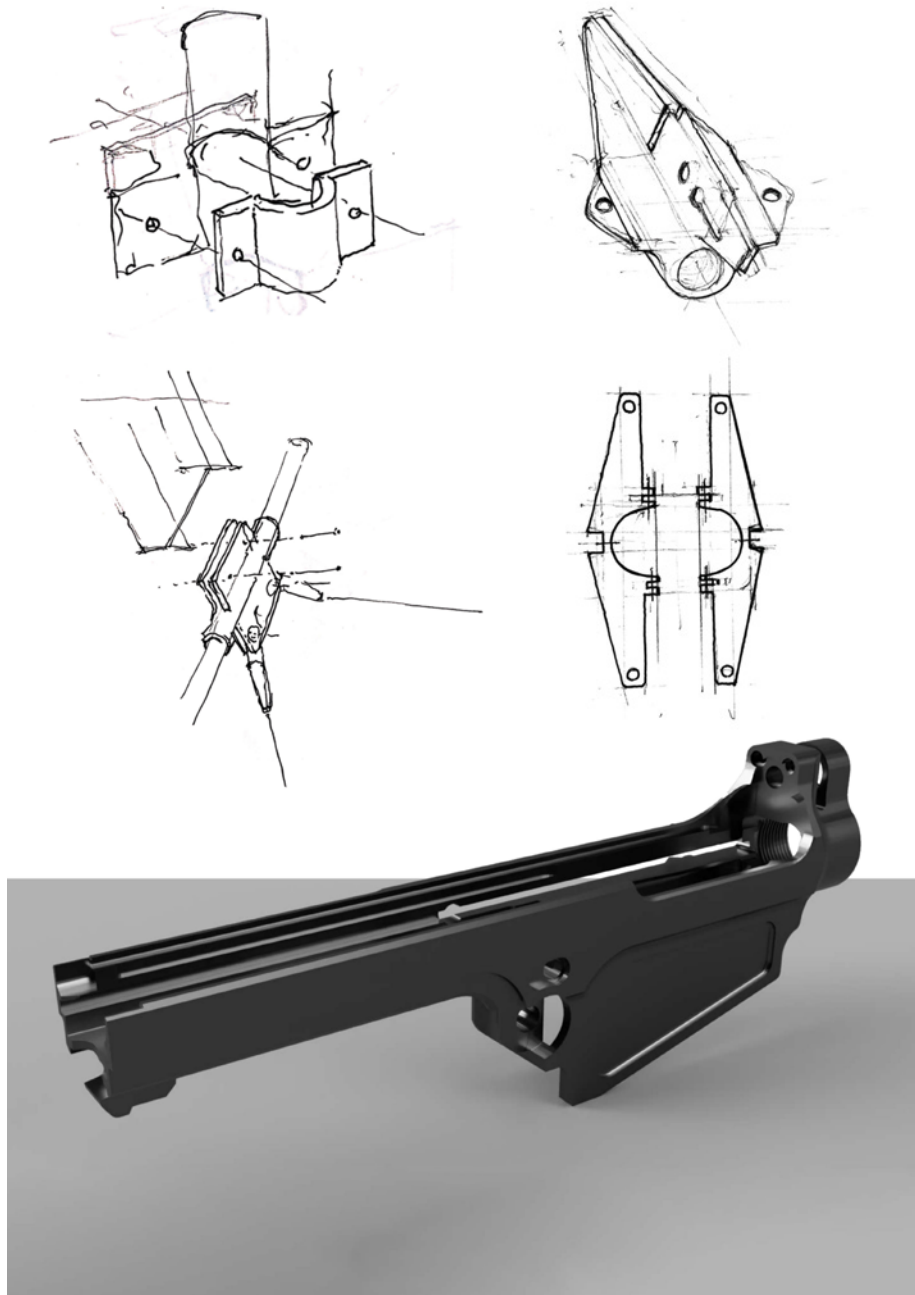


Figure 123: Testing potential designs of reference (author, 2023).

It is these mechanical parts that bear such recognition for the ones who learnt of the R1's workings.

Is a weapon responsible for its use? A gun is not put on trial for the wrongs of the holder. The majority of people prefer things to be black and white and get uncomfortable when shaded with grey. The ambiguous and the undefined create a sense of unease or uncertainty. This discomfort is sometimes necessary to remember the past. Dark Tectonics does not mean referencing the weapon in a specific light or framing it in a certain view. The tectonics of the weapon is meant to reflect and become a point to respond to and reference off of because of its historical significance. If we choose to forget the dark side of the past, we are at best guilty of selective memory and at worst contributing to the erasure of all those who endured it.

Most weapons are tectonic in nature (Figure 123), since they are constructed through the addition of parts. The receiver is the main housing component of a gun. It holds together the moving internal parts for firing and, in most countries, is the licenced piece that bears the inscription of the serial number and manufacturing details. It is the most important and difficult part of a weapon to produce. It is the component that connects every other part to a central point.

The proposed foundry produces metal from melted down firearms' parts, and, in the Design Development chapter, it will be shown how the thinking behind Dark Tectonics provided a form on which to base the design of a cast. Analysing the form of the receiver from the R1 can produce a new part to be the connecting point for construction - from destruction to joinery. The perceived casting goes further than moulding the shape of molten metal, referring the mind to the gun mechanism to remind of the mechanics of conflict.

It is this reminder of mechanical conflict that is the intended reference of the newly shaped object, to cast the mind to align with the uncomfortable memory that should not be repressed.

5.4 POST-NUCLEAR FALLOUT

The ‘togetherness’ of the theoretical stance in this document is complex in its arrival but revealed in the streams that form the river. The inverted monument is a challenging idea and to apply it should mean to take unique portions of the programme in abstraction of forms that can remind one of memory but not to dictate it. The Vietnam Veterans Memorial comes close to the inverted monument in concept, only shying away via the direct inclusion of names and the ‘memorial wall’. The difference between the inverted monument and the precedent is the deliberate intention to omit direct reference and focus on an experiential architecture.

An inverted monument of the nuclear weapons programme of South Africa is specific to its context. The existence of memorial walls and statues on both sides (the Freedom Park example) means there is no call for these names to be scribed onto stone. The greatest challenge is stimulating awareness of the spectre that darkly holds sway over the landscape – how to be unspecific but not vague?

The culture of technology plays a distinct role in post-nuclear exploration. This whole thesis exists around the conditions brought about by the militarisation of technology. Technology is defined here: the artifact or set of artifacts used in relation to human action or praxes, as described by Don Ihde in *Postphenomenology* (1993: 34), a work discussing the involvement of technology and the post-human experience of it. This is exactly the desired experience intended for the inverted monument of the South African nuclear programme, to elaborate the post-technological and memory of the past (Figure 124).

The conflict in Angola put people in the experience of undergoing sets of artefactual change, changes that are unique in their deliverance, i.e. the flesh-witness. The machines of warfare are the artefacts of change. The progression of these artefacts and the impacts thereof have harrowing effects on the user and the inflicted. The tendons that pulled the trigger are changed, and so is the flesh that held the projectile, the tragic outcome of this violence.

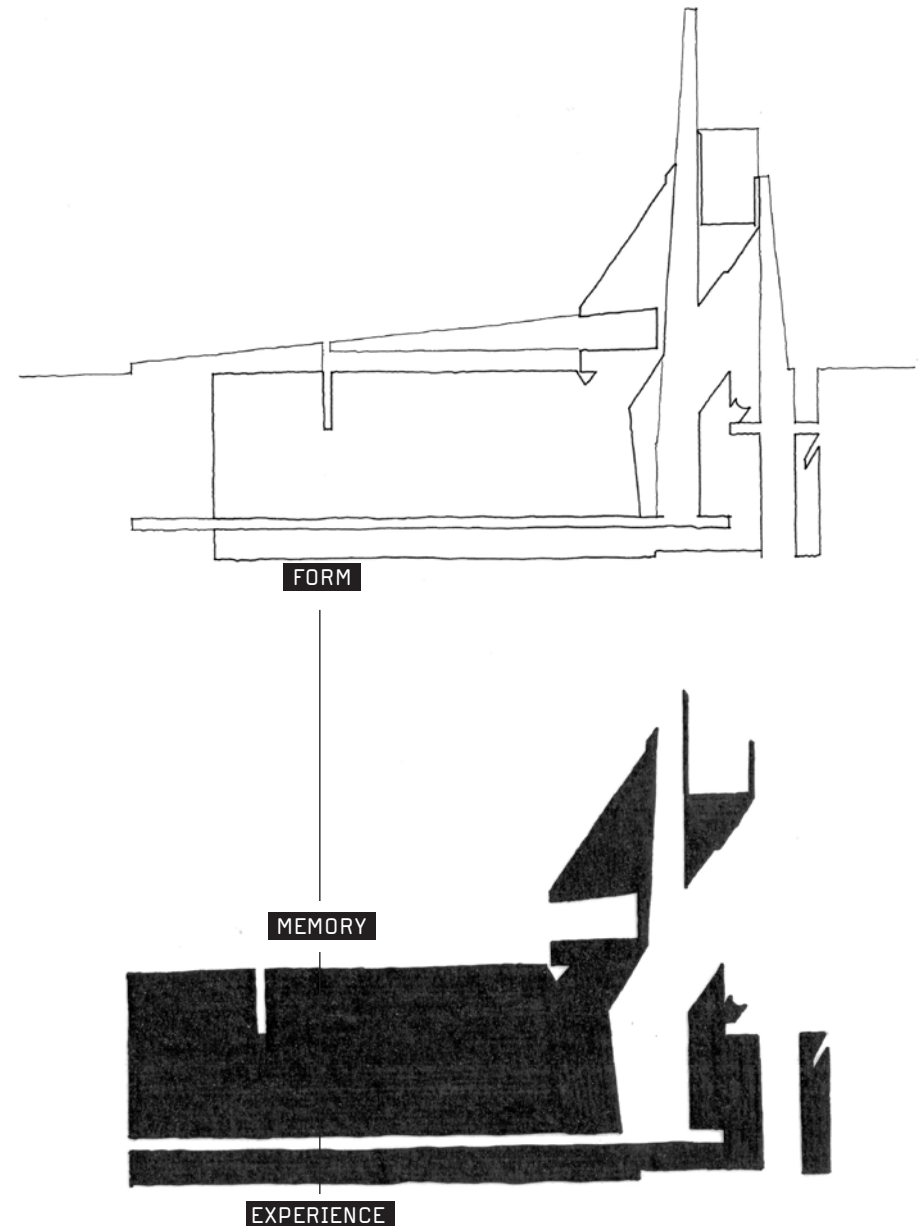
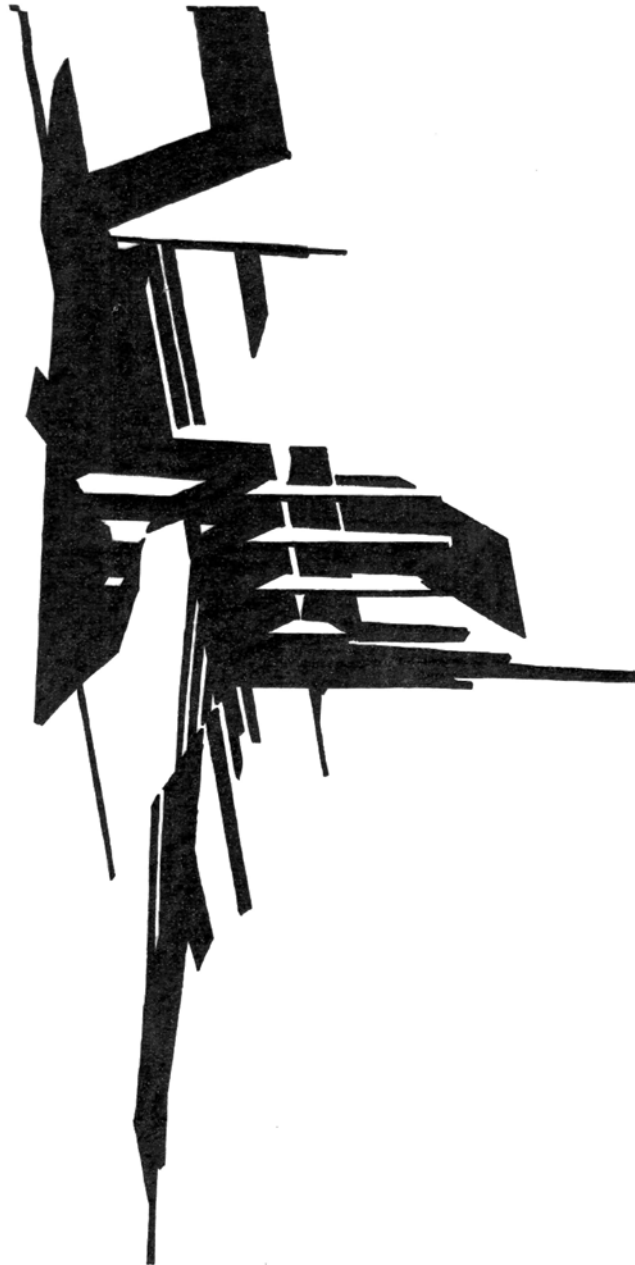


Figure 124: Drawing memory of the form (author, 2023).



The Being of the soldier is tied to the artefact of the weapon. The machine of war cannot exist without the progression of the device on which it runs. Radiating from this is the fallout of weapons advancement. The Cold War arms race is an integrated example of conflict fuelling the advancement of technology which affects cultures. The first nuclear explosion illuminated a change of immense post-phenomenological proportions. What else is so significant in the post-nuclear world? It was an inception that changed the basis of what Being could mean. The first spark of the nuclear bomb meant the human gained the faculty of self-annihilation and mass destruction on a level not yet achieved. The concept of nuclear deterrent provides the station by which rapid stockpiling of these weapons was sought.

South Africa, at one stage, was a part of this change. What was done cannot be completely undone, the site and landscape scars still exist, no matter how forgotten the site is. Those who went through the Border War still bear scars, no matter what the politics of the day might dictate. Unlike Angola, where rusted vehicles and mines are still left behind in the landscape, South Africa shows no physical fallout of memory to trigger reflection.

The human who holds the steel axe is a different being entirely from the one without one (Ihde, 1993: 34). The point is that technology is not merely an object. If it were, it would be something that simply sits to the side as 'junk', but these devices are part of human praxis so that they truly change one's way of Being.

Therefore, the inverted monument is attempting to tap into this corporeal engagement of memory in ways that are lacking in the current state of statues and memorial walls (Figure 125).

If the traditional memorial and the monument are land-anchored perceptions of withstanding conclusion and everlasting witness, one might say that all has been revealed in the understanding of the memorialised event. Meaning that, if these two types of built memory are intended to stand in permanent remembrance it is possible that the existence of these 'statues' state, by their very presence, and the memory of that particular event has been fully revealed in its concretisation.

Figure 125: Finding engagement with design drawings (author, 2023).

Although the two are separate in their execution, they are, in many ways, fragments of the same stone. The monument, being the most direct embodiment of this ‘conclusion of witnesses’, draws one deeply into a preconceived thought, taking with it the memories of the past. It is a headstone of remembrance, containing buried portions of revealed history, or rather, a narrative. The permanence and direct proposition of a monument, in some sense, is the becoming of ‘unconcealment’, meaning it does not leave any doubt in its intentions or opinions.

The memory of the Border War has been unconcealed in an entirety of built measures. The Freedom Park example shows how a state can choose to define memory through a specific lens and how it caused ‘opposing’ monuments to be constructed. Even though both sites capture the same picture, they are an ‘unconcealment’ of the complexity of remembrance – as if unconcealment is the goal. It would seem that through all the difficult and controversial discussions around the Border War that this would be the desired outcome. Yet does this direct sprawling out of any specific memories encapsulate the full picture?

Even more than the memory of the war, the nuclear programme existed in utter secrecy and still lingers in the singularity of concealment. The opposite of this veil is, at first response, a complete revelation of the details. It is a specific commemoration and construction of a monument and this is what is seen in the formations of memory of the Border War, the many monuments to the fallen. However, in this unconcealment something is lost.

The monument does not always probe deeper than the cliché, in some senses becoming all too much like propaganda, propaganda that plagues war reports on both sides. No state can be innocent of it. And it is this awareness that forces one to ask whether the inverted monument becomes more revealing in its concealment rather than unconcealment (Figure 126). The hiddenness that is captured in the invertedness is the spectre of the past, and this is what is lost so dreadfully in the monumentised. In allowing for something to remain partially hidden, it is ever-telling in its always new interpretation.

These are the ghosts that circle the Border War and the nuclear weapons programme; the propaganda of those involved, through hidden actions, deployed decoys and the secrets of the past that today may still not be revealed. This is how a poetic play of an inverted monument can ever reveal the secrets of the nuclear programme through the construction of concealment (Figure 127).

A secret programme – a concealed remembrance amid a propagandised war – an inverted monument.

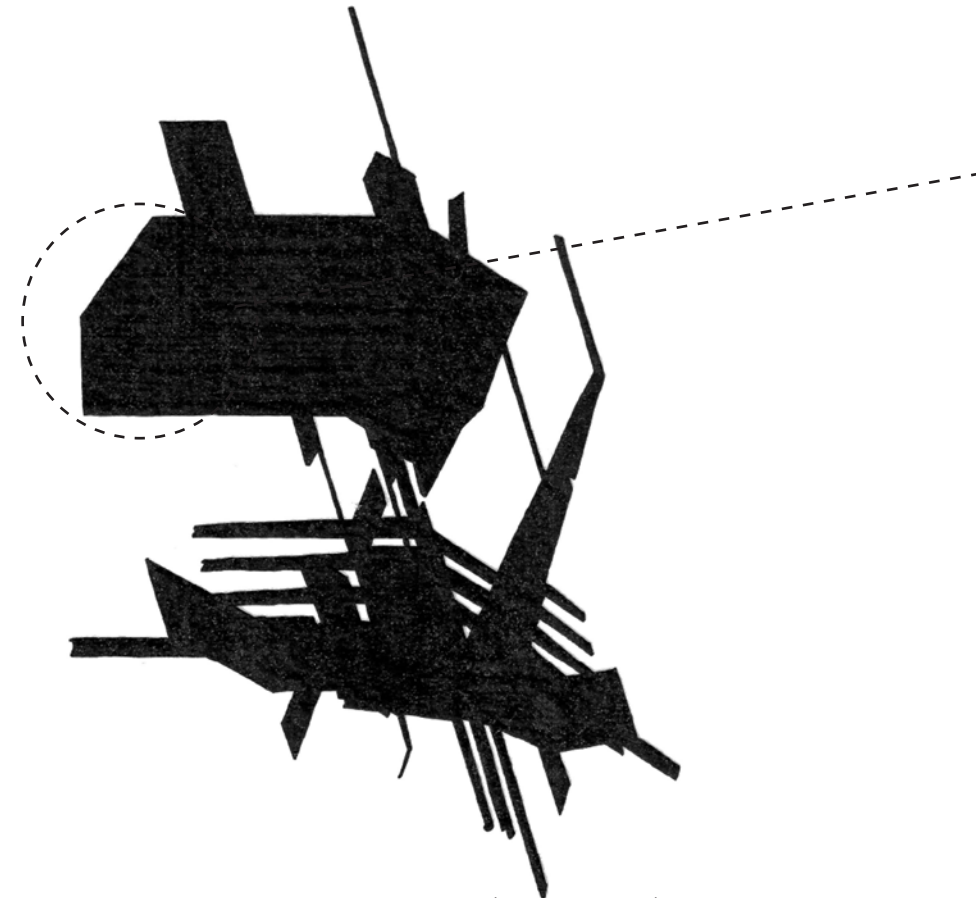


Figure 126: Concealing potential structure (author, 2023).

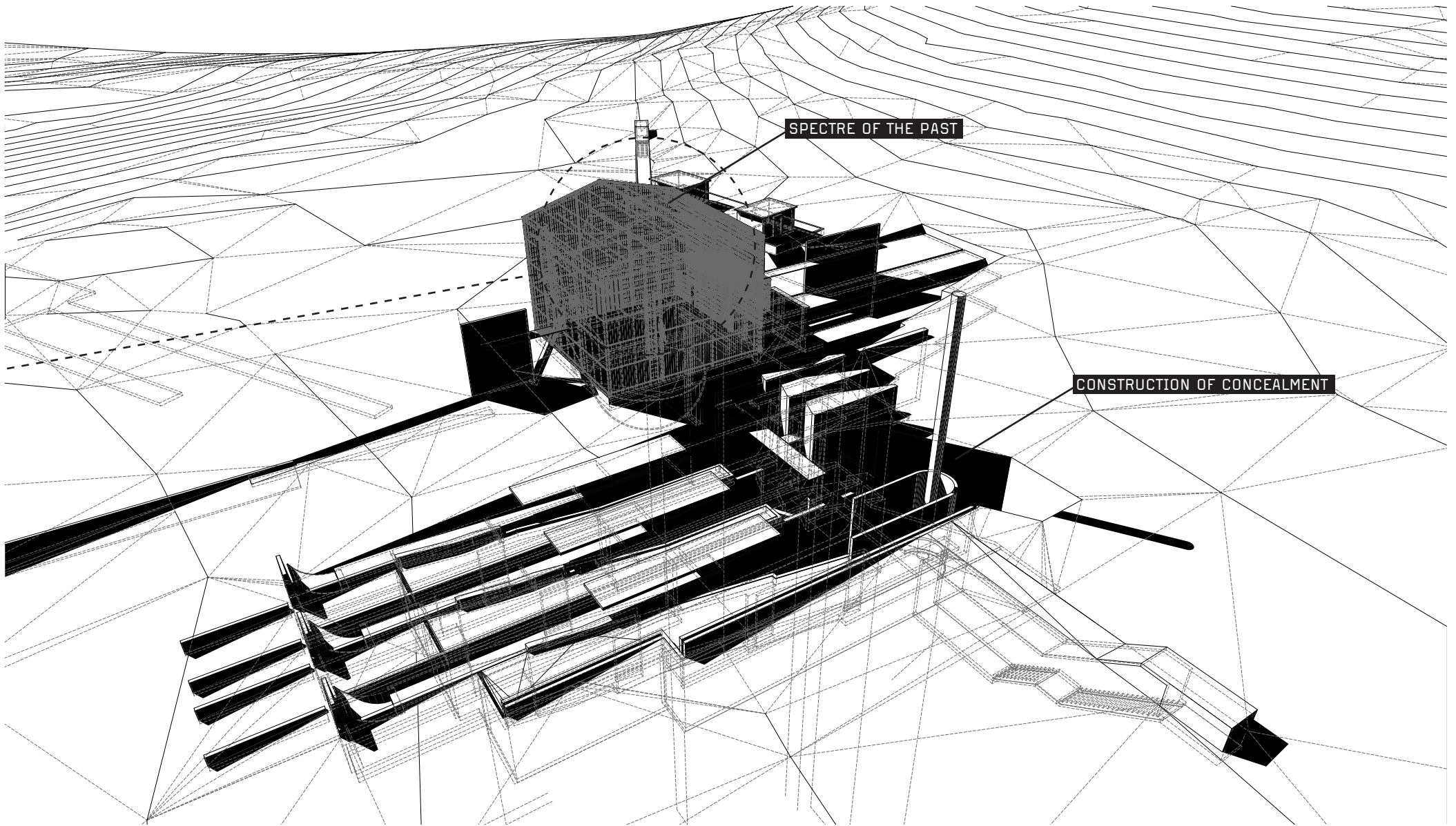


Figure 127: Speculating on revealing structure through concealment (author, 2023).

5.5 CONCLUSION

The architectural response to the memory of conflict can be formed in many different ways (Figure 128). This thesis concerns itself with looking at which kinds of built memory already exist (Figure 129), the monuments of the border war and the nuclear site. It is fascinating how structure can hold more than material, how it can hold the ideals of the past.

The concept of the inverted monument provides a way of commenting on the built memory of the Border War and the nuclear programme. Thus the overarching theory for the design is the inverted monument. Within the inverted monument are other details of conceptual work that can be used throughout the design. Different parts of the project may latch onto the differing ideas within the main conversation.

The concealment of the design, or features of the design that are too direct, creates intrigue for the person who views it. This is how further revelation is found in hidden forms. This creates a design methodology as well. Forms and shapes built upon each other can become discoveries by the unknowing of what exactly the original sketch is (Figure 130).

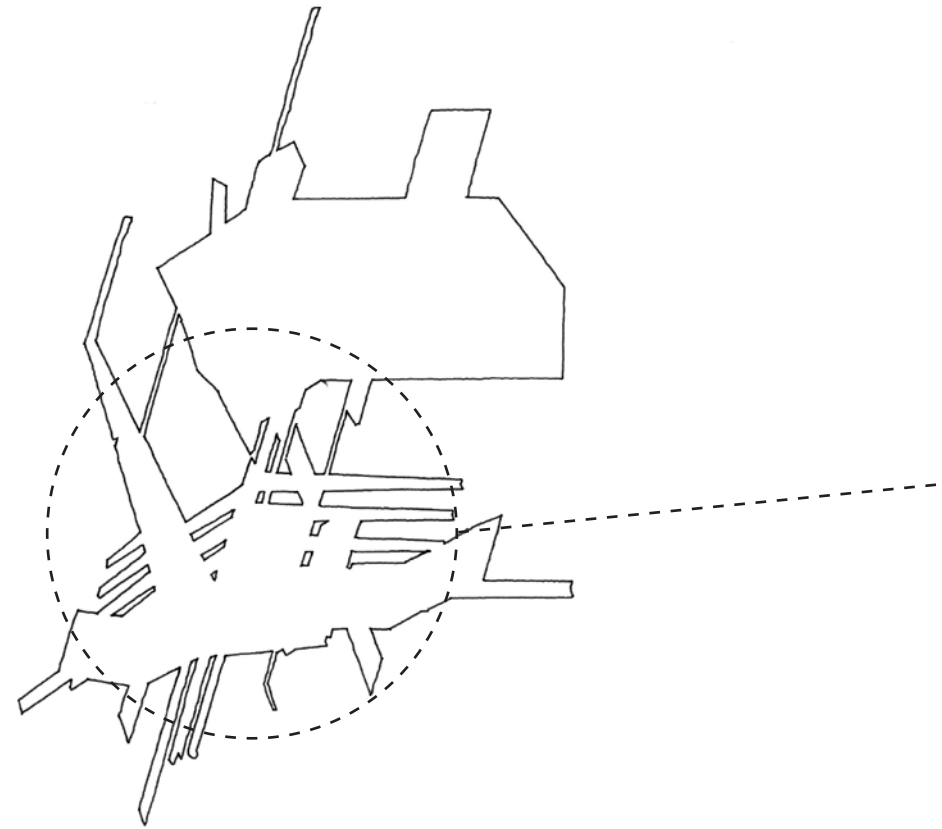


Figure 128: Concealment of form (author, 2023).



Figure 129: Fort Klapperkop (Baines, 2014).

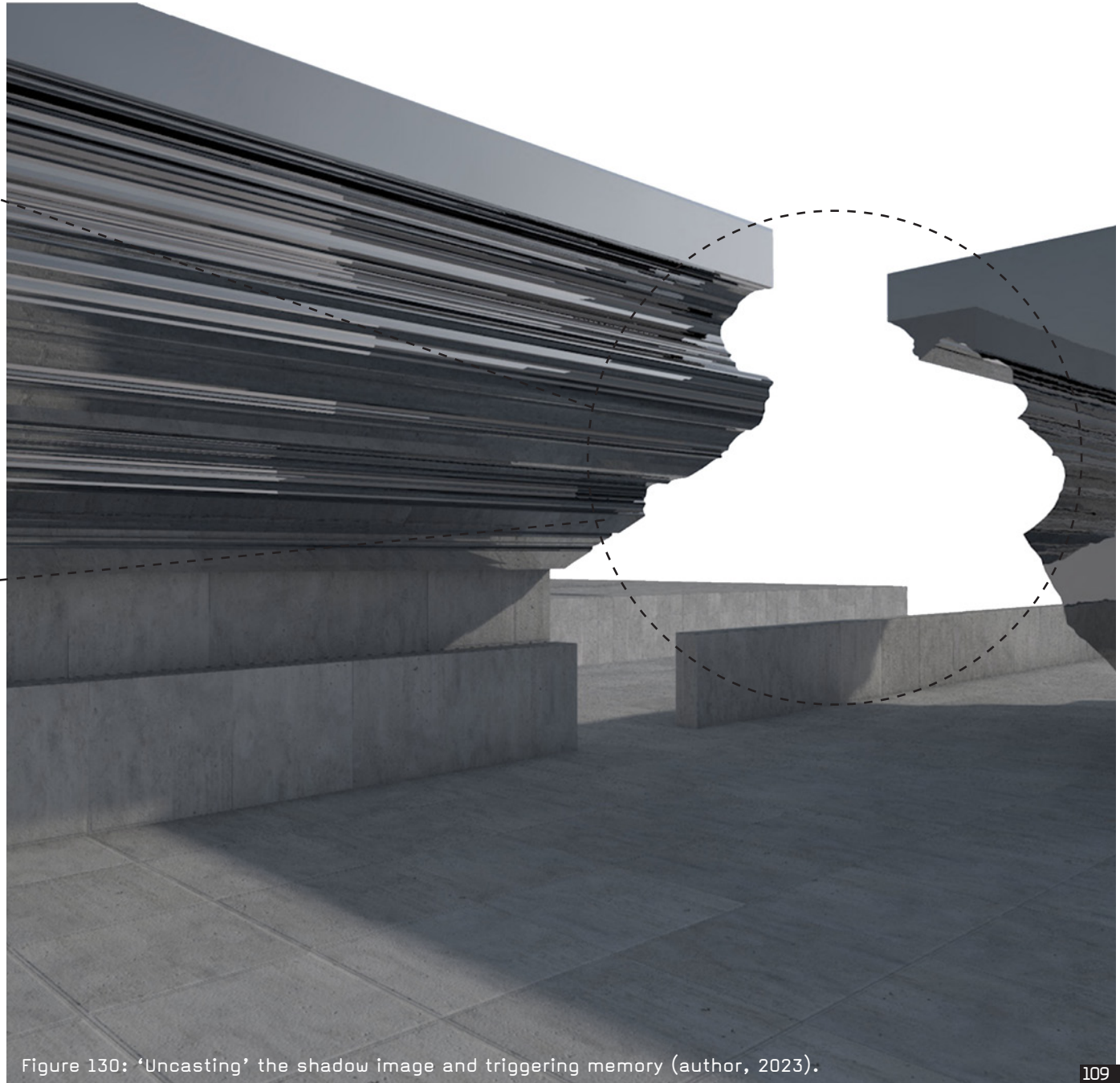
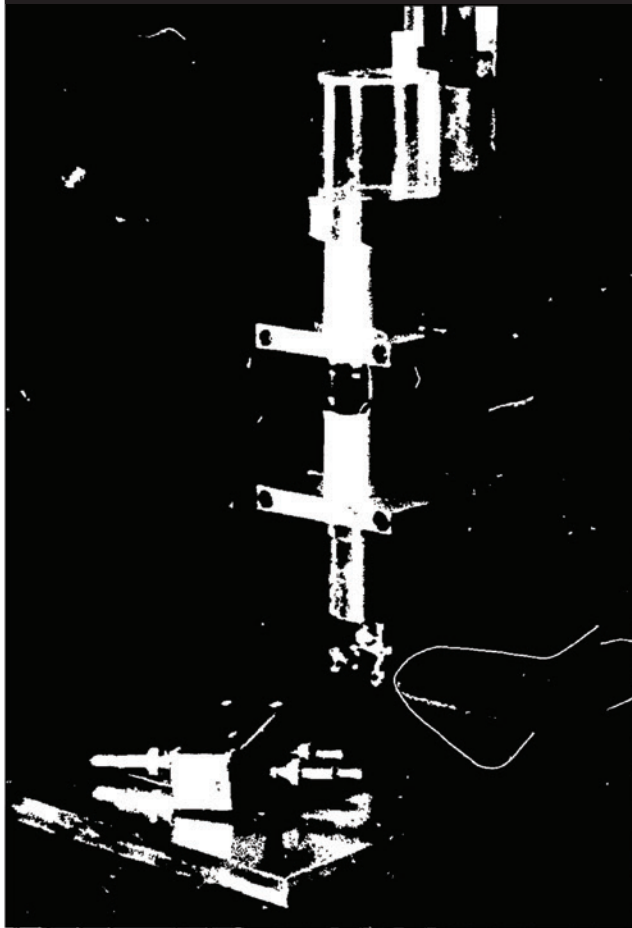


Figure 130: 'Uncasting' the shadow image and triggering memory (author, 2023).

CHAPTER 06

PROGRAMMED FORM



In water streams in the catchment areas of supply dams in our country. The water is placed in the glass sample holder, and the counter on the left gives a readout of



HEALTH AND SAFETY

The health and safety of all members of staff of the AEB are the concern of the Isotopes and Radiation Division and the Medical Services Centre.

6.1 INTRODUCTION

Now that the theoretical groundwork has been laid it is important to look at how this integrates with the programme to become the whole of what the ‘inverted monument is’ (Figure 132). The foundry and the nuclear exhibition space are separated by the control line, and so it is this that is crucial to the whole project. On the surface, the two programmes of the foundry and exhibition present themselves as the main content of the design, however, the true core of this thesis is that ghostly connection between the two (Figure 133):

Decommissioned Firearms Disposal | Spectres Of The Border War | The Nuclear Programme Exhibition

The Decommissioned Firearms Disposal is a foundry made specifically for the melting down of firearms and is integrated with Building 5100. Up to 60,000 firearms can be sent for disposal per year in South Africa (Serra, 2022). Currently, these weapons are sent to ordinary steel processing mills, which poses security risks. This dedicated foundry means smaller quantities of weapons can be delivered and a new type of metal is created from the melted down firearms.

Spectres of the Border War refers to the connection between the foundry and the exhibition building. This is the vital element of the programme that ties the whole project together and is the reason for unfolding the theory in the way it has developed. This part of the design exists between Building 5100 and Building 5000 along the control line. So, the remembrance of the history and context becomes a narrative to be experienced when travelling between the two structures.

The nuclear programme exhibition is a design integrated with the structure of Building 5000. It is meant to display the limited documents that have been released that detail what happened during the lifespan of South Africa’s nuclear weapons programme as well as temporary exhibitions. Integrated within the pathway, this point in the overall narrative is the turning point where the visitor is exposed to nuclear realities and mysteries.

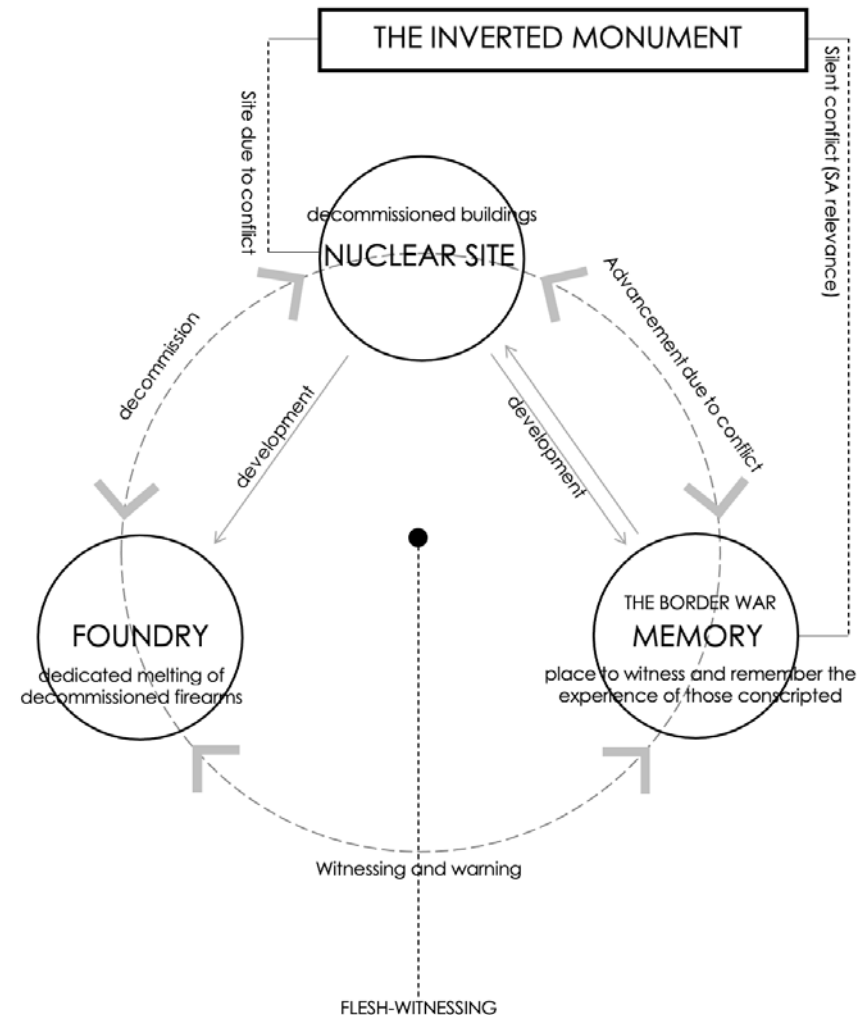


Figure 132: Diagramming the inverted monument (author, 2023).

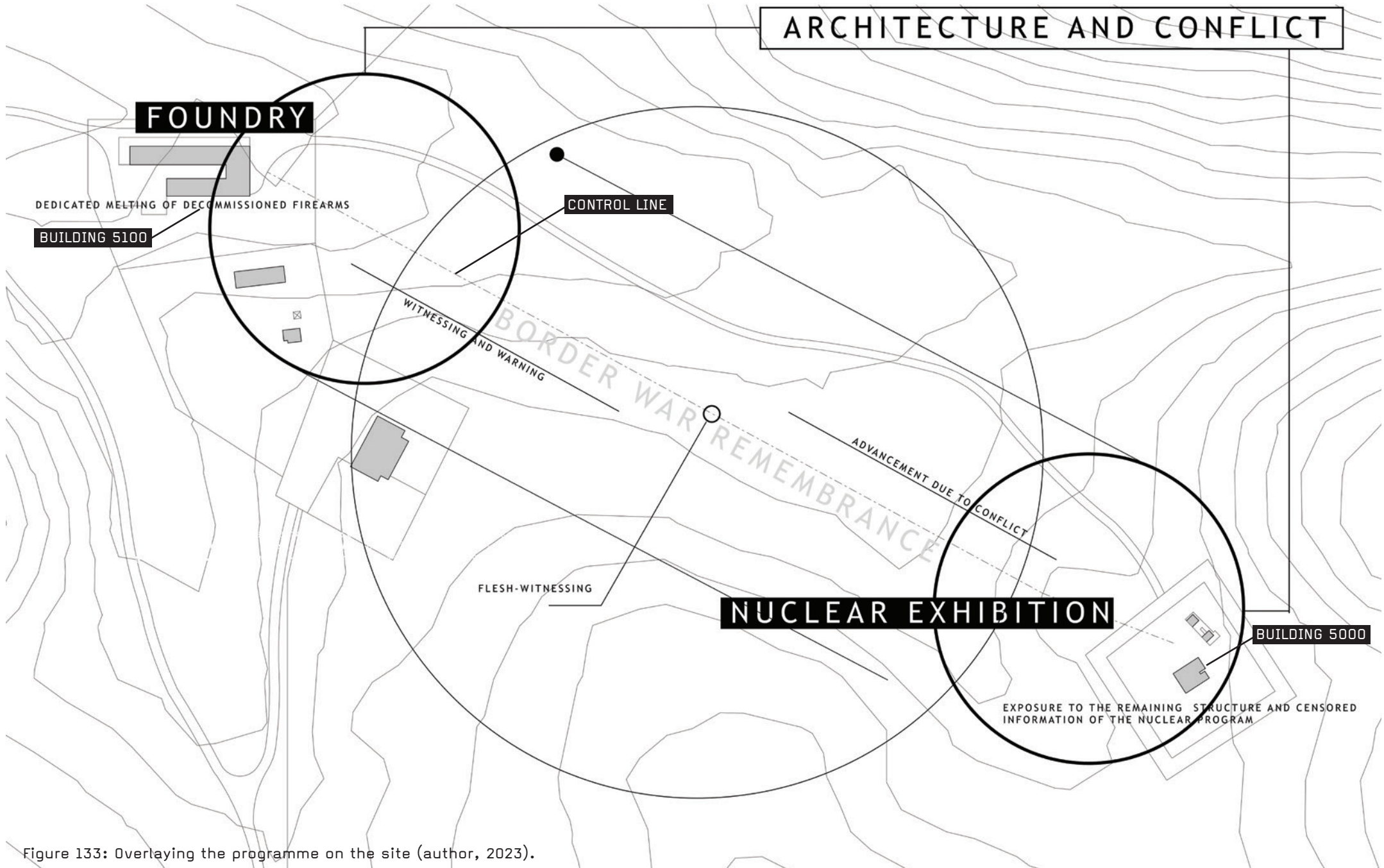


Figure 133: Overlaying the programme on the site (author, 2023).

6.2 FOUNDRY

The foundry provides a production facility of poetic meaning to be created in the site. Due to the historical significance of the site, a place for weapons creation, the disassembly of new firearms counters the historical narrative and highlights the significance of the dismantling of South Africa's nuclear arsenal in a world with the potential to light itself on fire.

The foundry further links to the memory of conflict, also acting as a statement to the 'de-mechanization' of warfare, a reclaiming of the soulless machined metal (Figure 134). It is a commentary on conflict and the specific history of the site.

At the core of this concept is the flesh-witness, attempting to bring the visitor from merely being an eye-witness into becoming a witness of the decommission and experiences of the site. This is a physical process of moving through not only the foundry but through the entirety of the inverted monument. It is the 'uncasting' and recasting of forms.



Figure 134: Firearms to be destroyed in South Africa (Serra, 2022).

The process for the foundry is as follows (Figure 135):

1. **Scrap Arrival and Sorting:** Initially, scrap weapons and weapon parts arrive and are sorted based on their metal types, with non-metal parts being removed.
2. **Secure Scrap Storage:** A secure storage area between the preparation stage and the furnace is provided. This area ensures that most of the metal can be processed in the furnace while offering advantages that typical foundries lack.
 - 3.1 **Induction Furnace:** Electric induction furnaces are employed for melting down various metal parts, allowing the molten metal to be poured into casting moulds.
 - 3.2 **Sand Mold Creation:** Simultaneously, moulds are created and filled with prototype forms for casting.
 - 3.3 **Mould Preparation:** Moulds are readied in line for multiple casting operations using the molten metal from the furnace.
4. **Molten Metal Casting:** Metal is poured into the moulds and then advanced in the process.
5. **Casting Retrieval:** Moulds are disassembled after cooling to retrieve the cast metal.
6. **Sand Recycling:** The sand from the moulds is recycled back into the mould creation phase.
7. **Casting Finishing:** Finally, casts are meticulously finished through brushing and tempering if necessary.

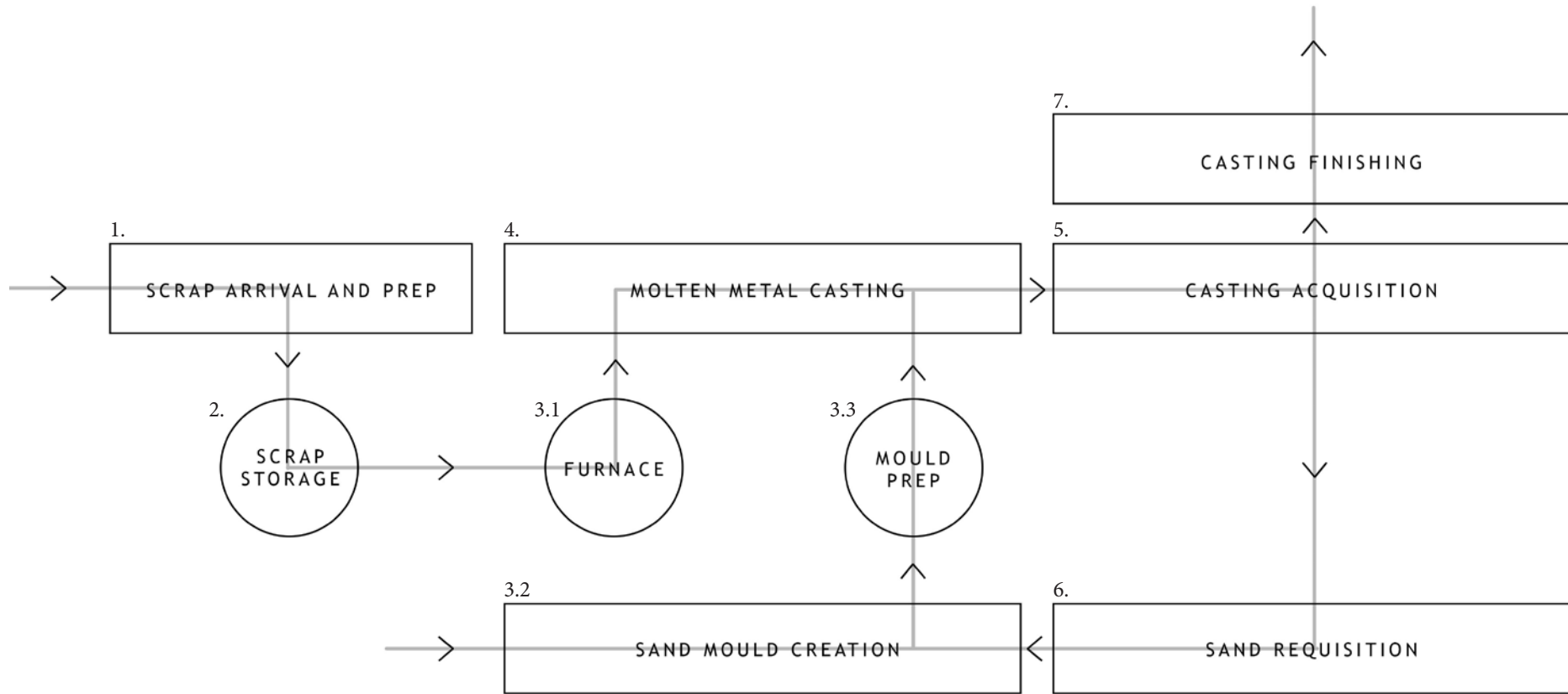


Figure 135: Diagram for the foundry process of Building 5100 (author, 2023).

6.3 NUCLEAR EXHIBITION

The nuclear exhibition space is separated into two functions: firstly the area for display and exploration within the structure, and in fusion with this is the production facility of [REDACTED]

The first aspect is dedicated to the display and exploration of nuclear-related content within the structure. Here, visitors can immerse themselves in the exhibits and gain misted insights into South Africa's nuclear history (Figure 136), offering a space for reflection.

The production facility for [REDACTED] While the primary purpose of the exhibition is to [REDACTED] This dual function enriches the [REDACTED]



Figure 136: Example exhibition by Vincent Bezuidenhout, “She watches over” (Bezuidenhout, n.d.).

The process for the nuclear exhibition is as follows (Figure 137):

1. **Entrance:** Visitors arrive from the path and enter the exhibition space, catching glimpses of restricted sections.
- 1.2 **Restricted** [REDACTED]
- 1.3 **Restricted** [REDACTED]
- 2.1 **Public Exhibition:** The main exhibition space displays a collection of declassified documents related to the nuclear programme's history.
- 2.2 **Restricted** [REDACTED]
- 2.3 **Restricted** [REDACTED]
3. [REDACTED]
4. **Witnessing:** Visitors can observe the interior of the existing building while waiting for the arrival of ‘the neutron from outer space’, a new revelation and understanding of that which was historically obscured. Then visitors move through and out back onto the path.

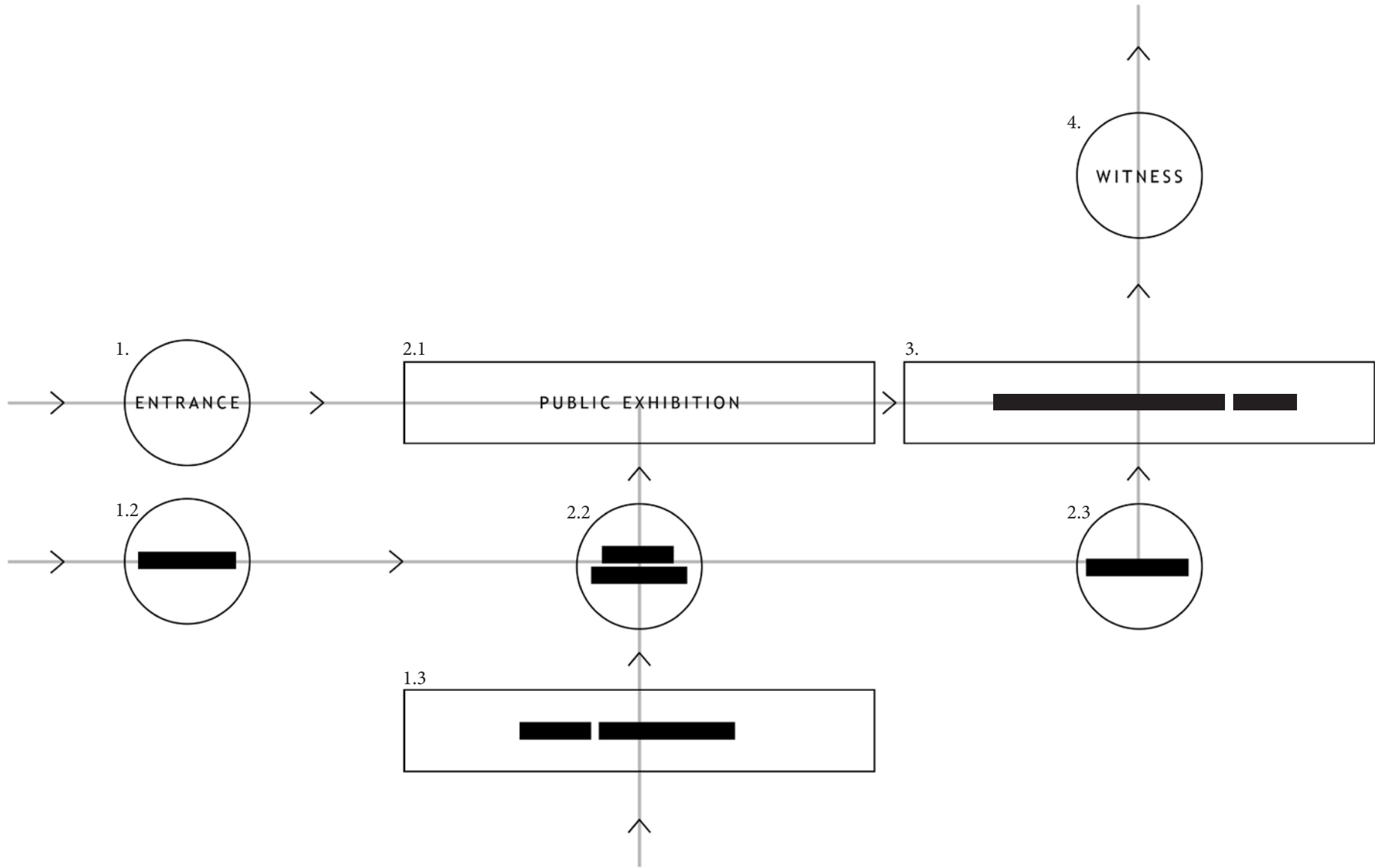


Figure 137: Diagram for the exhibition and [REDACTED] process of Building 5000 (author, 2023).

6.4 CONTROL LINE

The control line is the connecting vein between Building 5100 and Building 5000 and now becomes the place of memory between the two structures. The ever-important context and history of the nuclear buildings are centred around this line, just like the long line of soldiers in the terrible Border War is the centre of the origin for nuclear weapon development. It becomes incredibly important as to how the design will centre itself around the spectral spine of the site.

The initial approach taken here can be diagrammed into a simple reaction (Figure 138). The path between the two buildings adheres to the control line or it deviates from it. When adhering, the path is strict, cutting through landscape, marching forward. When deviating from it, the path begins to follow the natural curves of the land (Figure 139). Although simplified, this overall approach can be included with the intention of narrative and point of referential memory to create a detailed core.

With this adhering and deviating, the new pathways of there and back will evidently have meeting points. These points form engaging exchanges where those traveling along one path meet up with those traveling back along another pathway. These meeting points are different depending on the visitor's point of view, mimicking a connection point where one still experiences a disconnect.

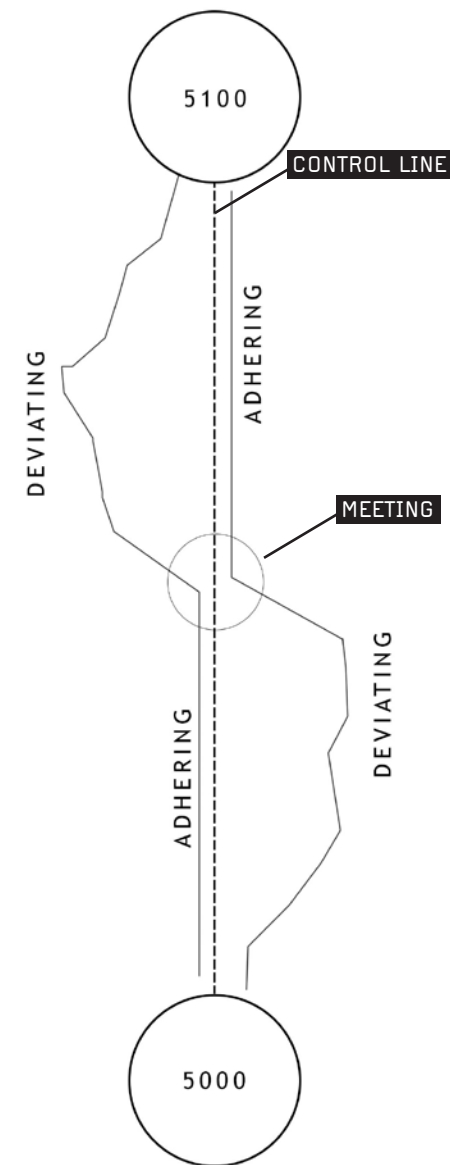


Figure 138: Diagram of the basic involvement with the control line (author, 2023).

6.5 CONCLUSION

Through this theoretical framework one can begin to understand the intricate interplay between the foundry, the concept of spectres of the Border War and the nuclear programme exhibition which together form the essence of this architectural endeavour.

The Decommissioned Firearms Disposal foundry represents a crucial component of this project, addressing the pressing issue of firearm disposal in South Africa as well. The integration of the foundry is a symbolic melting down of weapons on the site where nuclear weapons were dismantled.

“Spectres of the Border War” serves as the elusive connection between the foundry and the exhibition building. This element breathes life into the entire project, weaving a narrative that spans between Building 5100 and Building 5000 along the control line. This narrative allows visitors to engage with the history and context of the project as they move between these two structures, forging a poignant connection between past and present.

Finally, the nuclear programme exhibition, integrated within Building 5000, serves as a pivotal point in the project’s narrative. Positioned along the pathway, it becomes the turning point where visitors are confronted with the mysteries surrounding nuclear technology. It is a place of pause and reflection.

The ‘inverted monument’ is not merely a juxtaposition of a foundry and an exhibition space; it is a carefully orchestrated place to position one between remembrance and narrative.

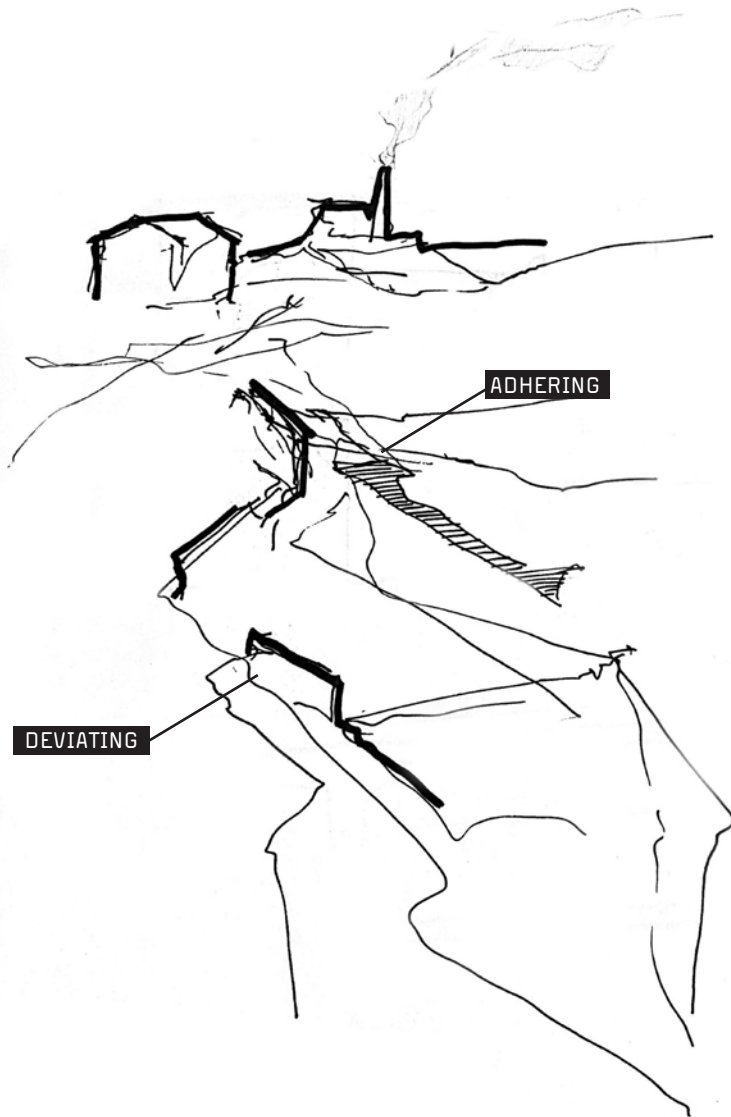


Figure 139: An important sketch of the path engagement (author, 2023).

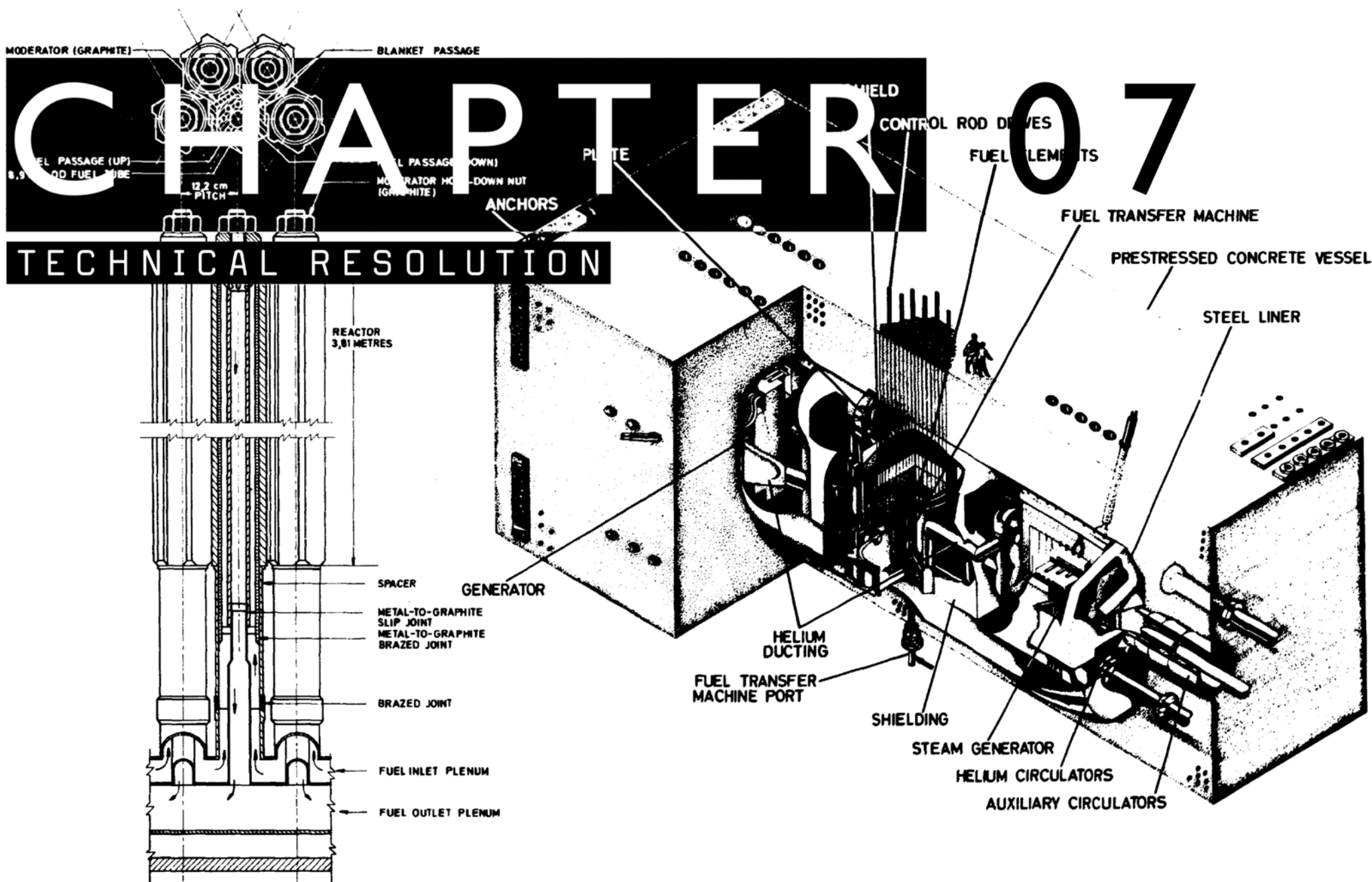


FIG.4.3 REACTOR CORE CELL

PRESTRESSED CONCRETE REACTOR VESSEL AND INTERNALS FOR THE 1000 MW(e) GAS-COOLED FAST REACTOR

7.1 INTRODUCTION

The technical resolution of this document is based on a few considerations that can all be related back to the conceptual work and site-specific reactions. In terms of site natural terrain, landcover and viewshed densities are considered. The construction touchstone (Figure 141) takes these considerations into account to form a basic architectural response to attempt to guide the structure further towards a completed design. The touchstone implements weapon tectonics as a concept and how that can work as a device for triggering memory. Tying these structural techniques together then comes the use of material, the choice of which plays a further important role in the construction altogether.

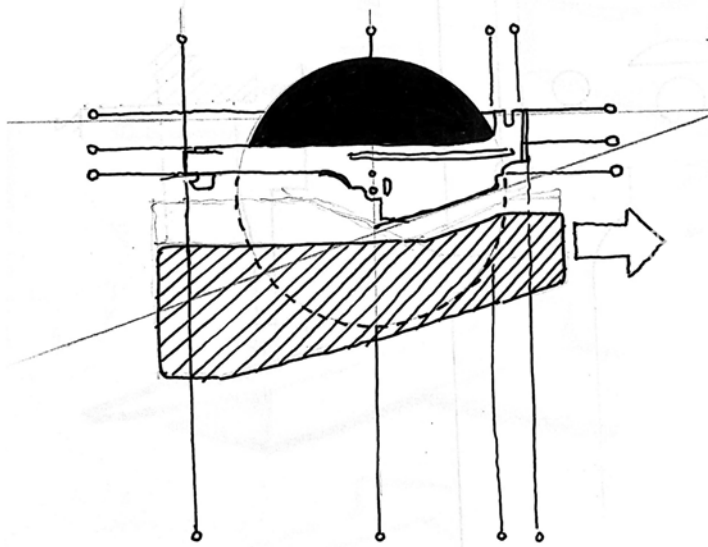


Figure 141: Diagram for technical reaction (author, 2023).

7.2 SITE CONDITIONS

Pelindaba is situated within the beautiful landscape of the Magaliesberg region (Figure 142), where the natural topography is characterized by rolling hills, valleys, and the presence of fault lines that traverse the area. This geological significance is further enhanced by the proximity of the Hartbeespoort Dam. The site itself is nestled amidst a blend of two distinct vegetation types, namely the Gauteng Shale Mountain Bushveld and the Zeerust Thornveld (GA Environment, 2021) (Figure 143). This combination of ecological zones contributes to gravel-like soil conditions.

The terrain in and around Pelindaba is marked by the prevalence of natural shale rock formations integrated into the landscape. These rocky outcrops are interspersed with low bush growth. This rich and diverse environment not only underscores the region's natural beauty but also adds to the significance of Pelindaba as a site of both natural and historical importance. It is almost ironic that the government would create a site that produces nuclear waste in a place known for its natural beauty. Yet, as of recent years, the whole area seems to be in some sort of decay, noticeable by invasive plant species and accumulating trash litter.



Figure 142: The site topography (Google Maps, 2023, edited by author).

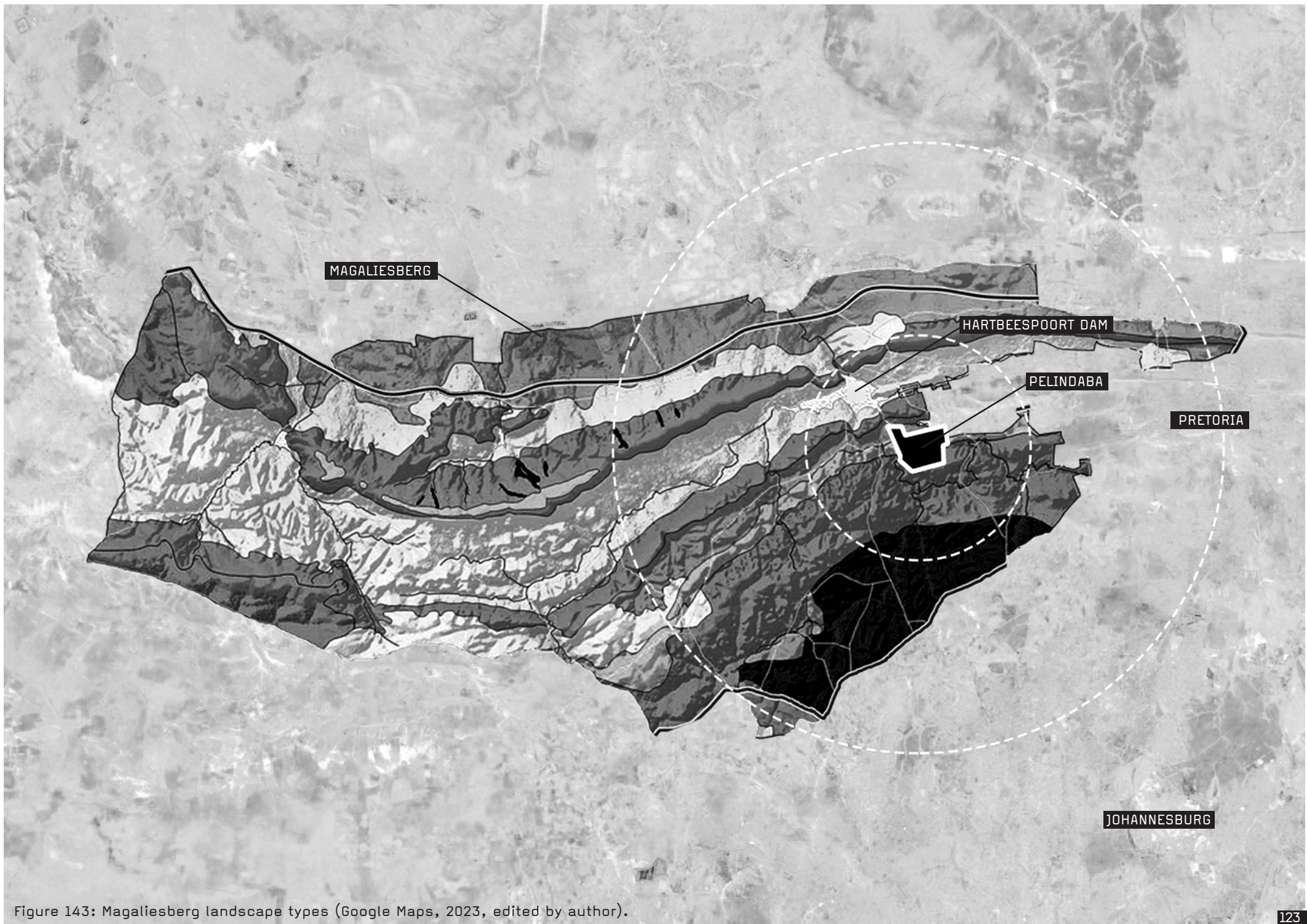


Figure 143: Magaliesberg landscape types (Google Maps, 2023, edited by author).

The site's natural beauty lies in its simplicity, with wild grass covering the area and trees clustering in valleys but becoming less frequent at higher elevations. The shale rock found throughout the site is locally used in constructions, such as the Preller house, showcasing a blend of architecture and the environment. Pelindaba's natural landscape before industrial intervention lies beneath what is built (Figure 144).

Vegetation growth

Shale rock outcrops

Highveld grassland

Gravel soil



Figure 144: Path along the hills in Pelindaba (author, 2023).

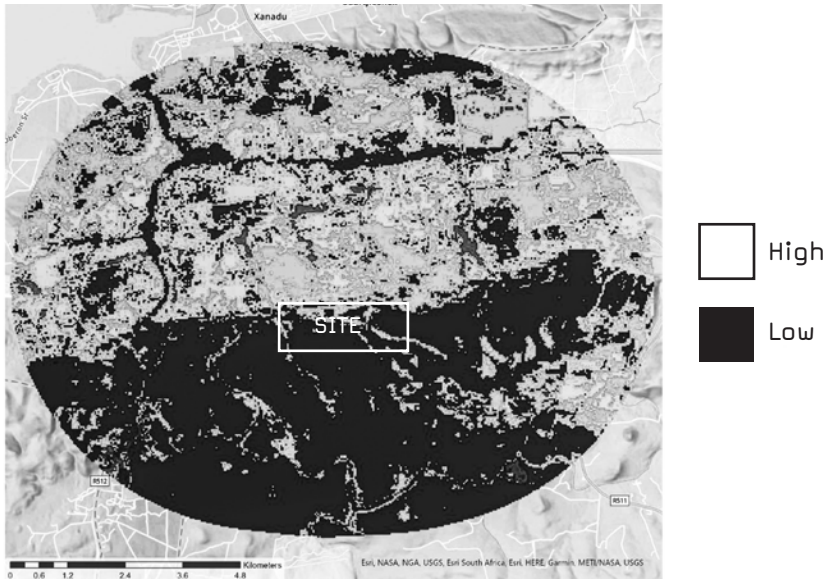


Figure 145: Landcover map (GA Environment, 2021, edited by author).

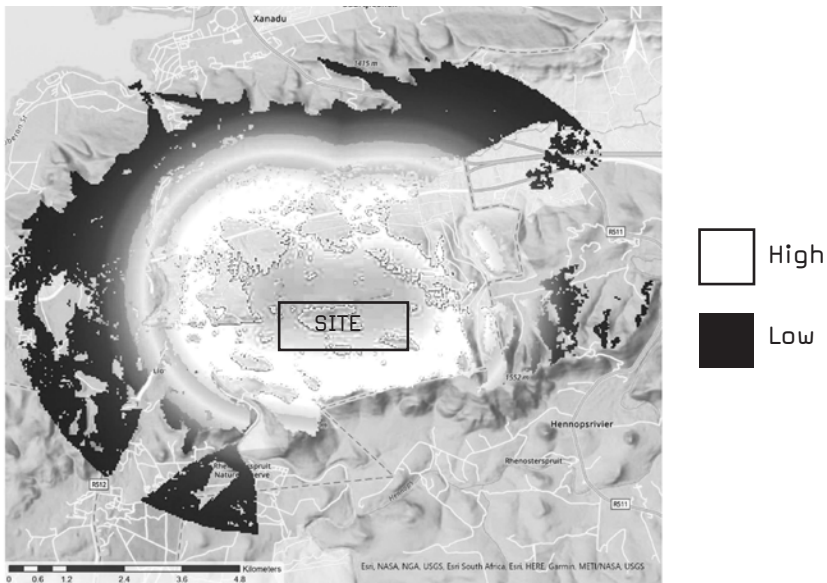


Figure 146: Viewshed map (GA Environment, 2021, edited by author).

The landcover map (Figure 145) shows the density of built areas in a five-kilometre radius around the site. The darker areas represent low to no density of manmade structures. The original choice for the location of the site can be seen in how few people would venture to that area, contributing to its concealment. However, nearby are large population centers for those wanting to visit Hartbeespoort Dam.

The viewshed map (Figure 146) indicates if the site is visible within five kilometres from any point of the map. The darkest areas indicate no visibility and lighter ones indicate somewhat visible. The map is slightly deceiving because the site can only be noticed within roughly one kilometre. The principle in itself is however fascinating when compared to the landcover map, the locations of higher-density built areas are also prevented from viewing the site facilities. This was most certainly intentional planning to keep the concealment of the nuclear weapons programme.

7.3 CONSTRUCTION TOUCHSTONE

The construction touchstone intends to be a mark against which the structure of the design can be tested. The principles of the touchstone are derived from the site and how technical structure can respond fittingly to it (Figure 147). That response is put in addition to the tectonics of triggering memory, or dark tectonics.

This exploration can be seen as a continuation of the initial design exploration, further emphasising unfolding a system for design response while keeping the lessons learnt in the first conceptual phase. One of the main components of the touchstone is the reference to the weapon (Figure 148).

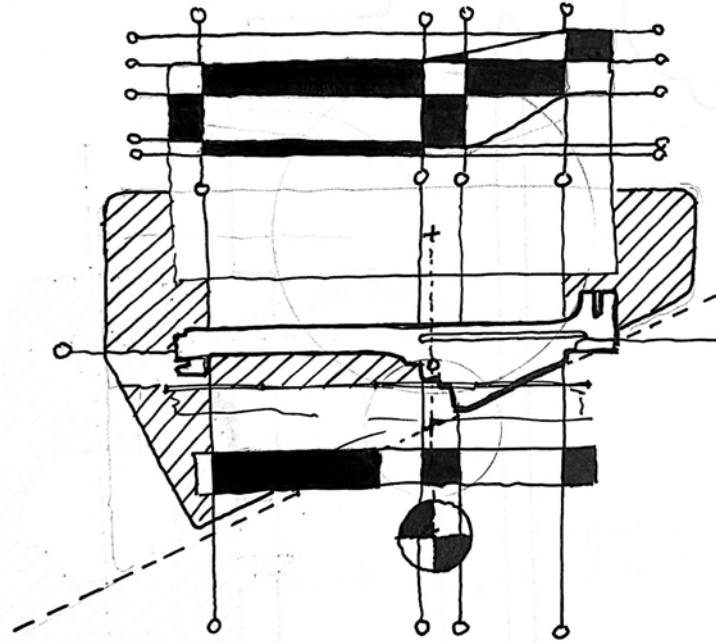


Figure 147: Technical diagram of a weapon (author, 2023).



Figure 148: The weapon (Cashner, 2013).

The main points that the touchstone focuses on can be elaborated on in the following ways:

- Ground response: The stereotomic quality of the earth and rock that is the make-up of the ground on the site can become reflected in the design. The act of digging in and under the earth is a kind of reflection of the natural stone found in the landscape. By sinking in and creating slits through to the surface, the structure can engage the soil from within and bring shafts of light through to the underneath.
- Concealment: Along with engaging the earth, the structure is concealing itself twofold. Restricting structure from natural view is a mimic of the concealment within the project as a whole. Then by allowing parts to reach out from underneath and parallel with the landscape, there is a restricted disclosure of what lies beneath.
- Weapon tectonics: In order to disclose what is concealed, a certain form can be adopted for reference. The firearm receiver of the FN FAL provides this structure to trigger memory and draw interest.

The touchstone begins its response with a reaction to site, then the programme and finally a refined conceptual form relating to the theoretical expression (Figure 149).

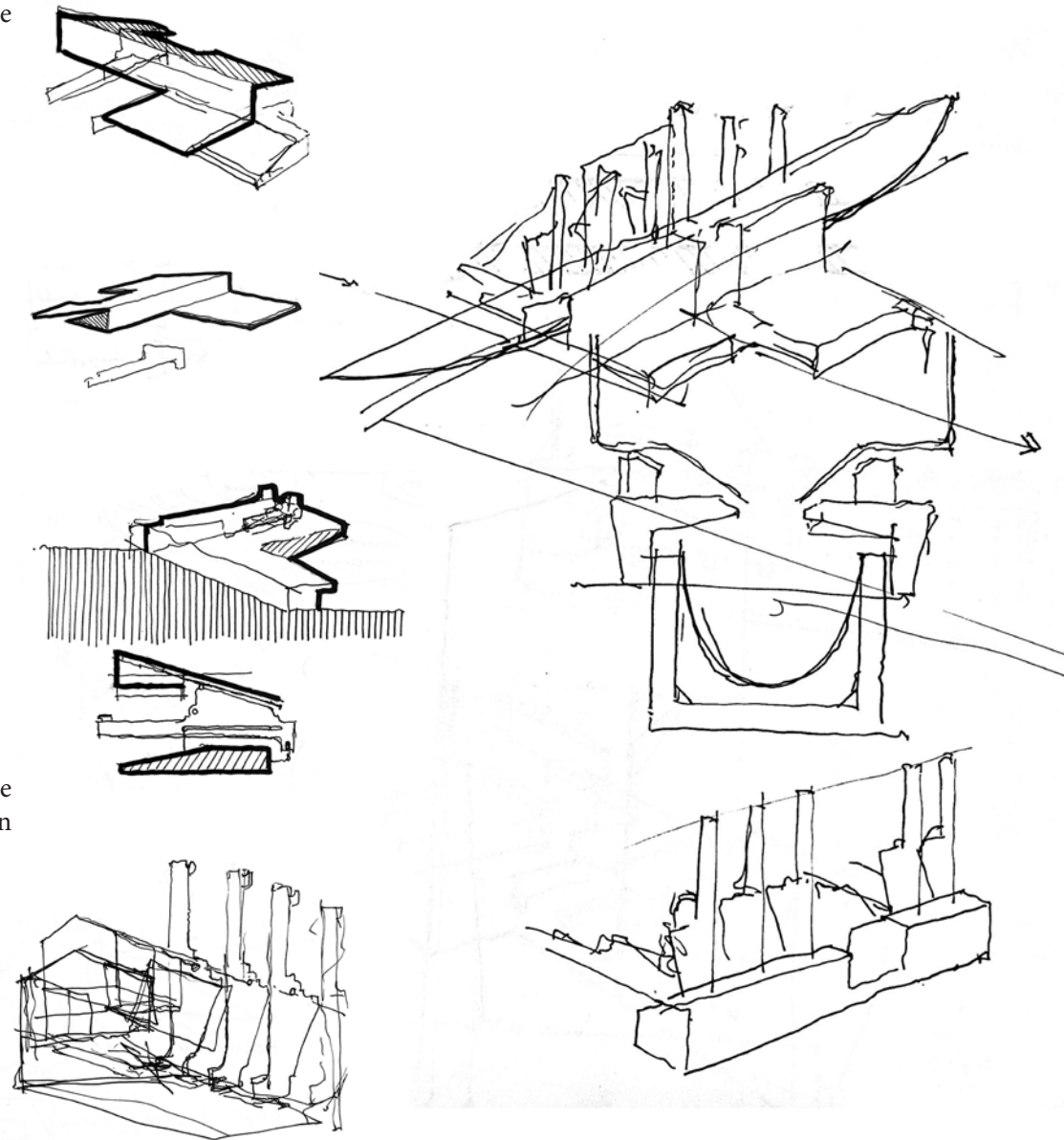


Figure 149: Sketches discovering forms around site and weapon (author, 2023).

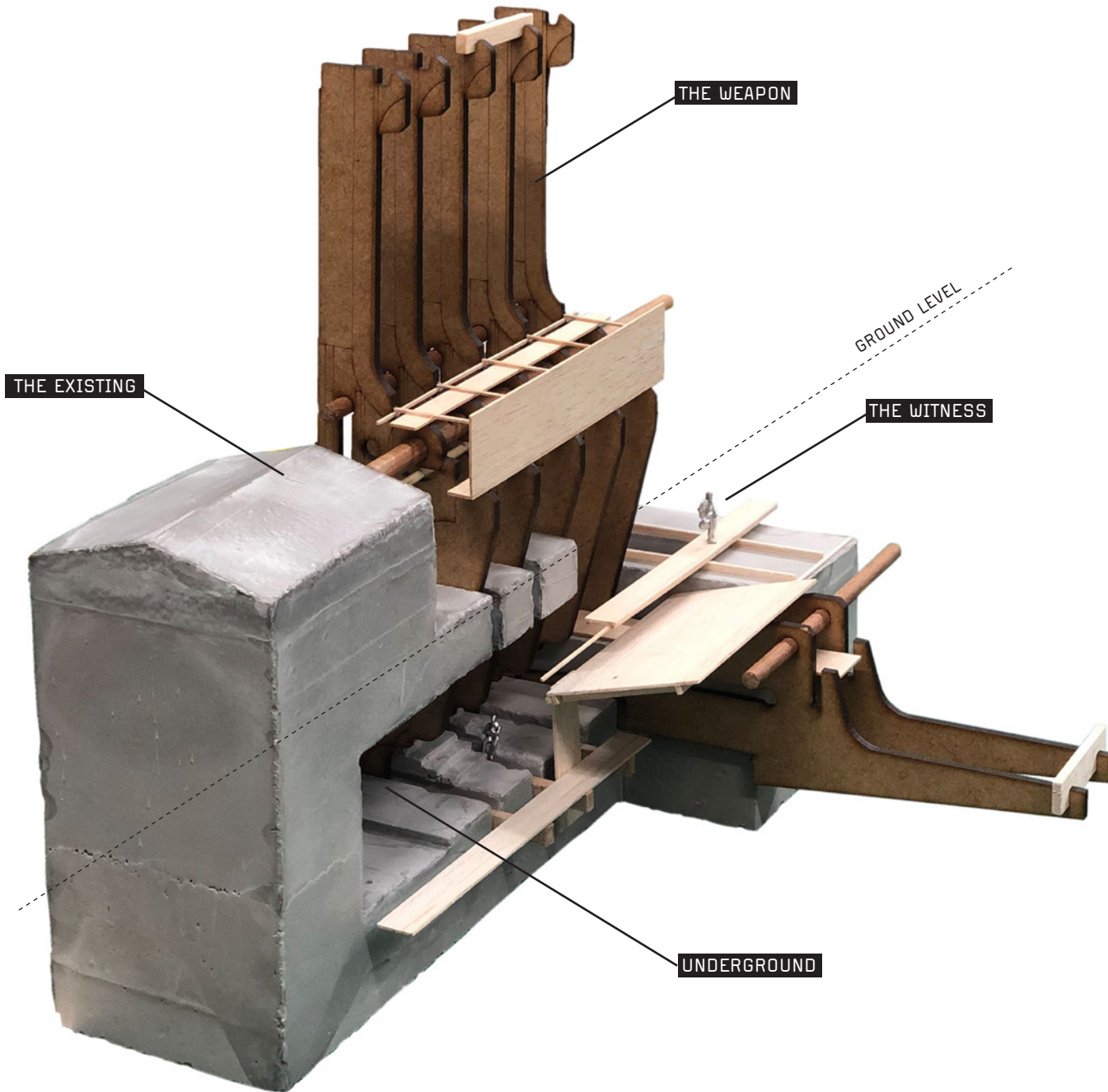


Figure 150: The construction touchstone (author, 2023).

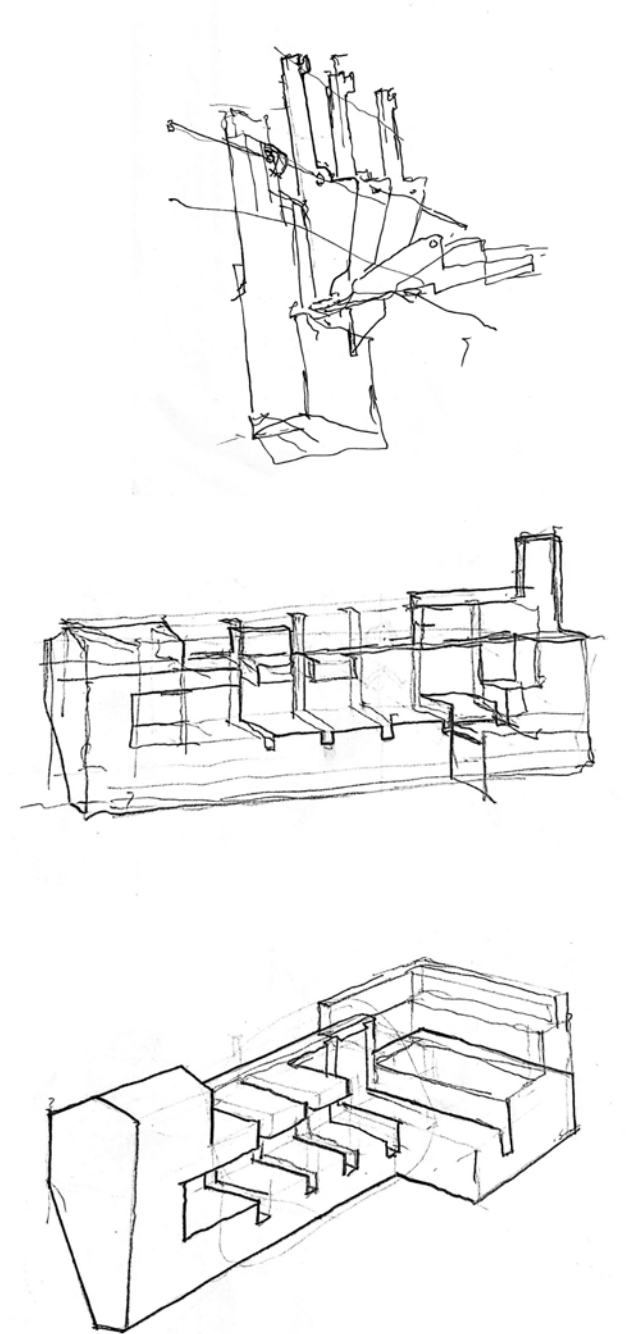


Figure 151: Sketching the concrete, stereotomic site (author, 2023).



Figure 152: Sitting in the gap (author, 2023).

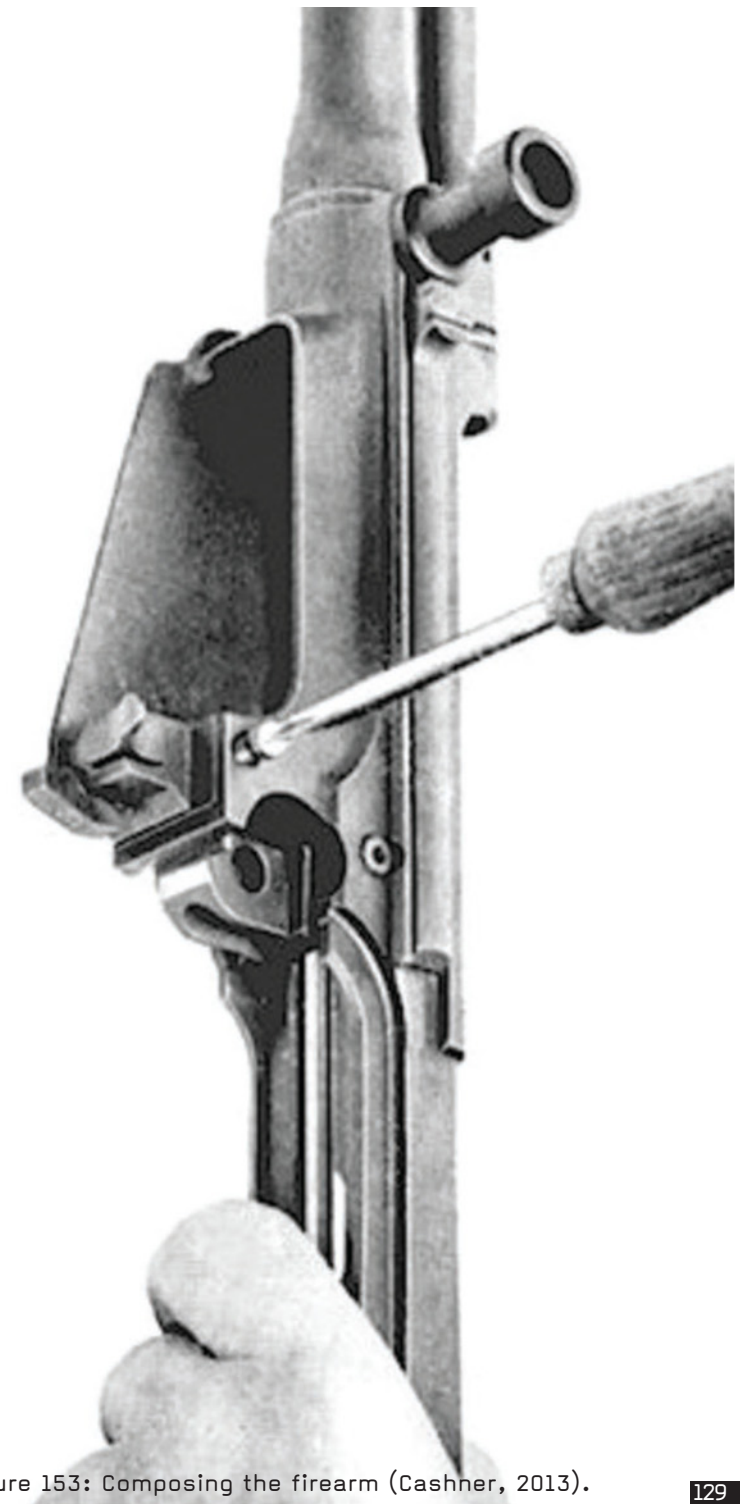


Figure 153: Composing the firearm (Cashner, 2013).

7.4 CRITICAL MORPHOLOGY

The “Godiva” device refers to a series of critical assemblies used for nuclear research and testing at Los Alamos National Laboratory during the mid-20th century in the USA (Myers, 1996). These assemblies, also known as “Lady Godiva” for their visually striking configurations (Figures 154 and 155), were designed to study the behavior of nuclear materials and test their criticality (the point at which a nuclear chain reaction becomes self-sustaining). The Godiva experiments were significant in advancing our understanding of nuclear physics and safety. They played a crucial role in the development of nuclear weapons and reactor technology during that era.

This type of reactor is very similar to the reactor designed by south Africa that would have been used in Building 5000. However, there are no photos of any of this equipment since South Africa allegedly destroyed all the documentation of the programme. This is why it is interesting to look back at what was designed in the Los Alamos experimentation. Even though the machine is without doubt not identical in construction, the principle of testing criticality is the same as that which was conducted in Building 5000 and the only diagram of south Africa’s critical reactor does appear to match up in similarity.

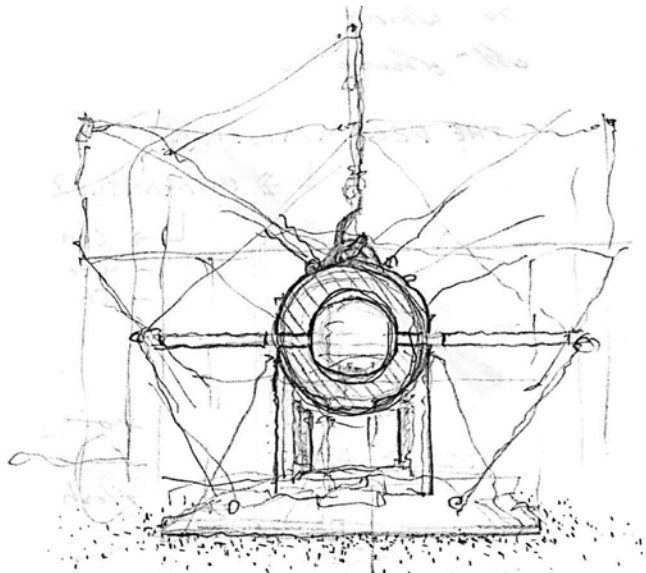


Figure 154: Critical morphology (author, 2023).

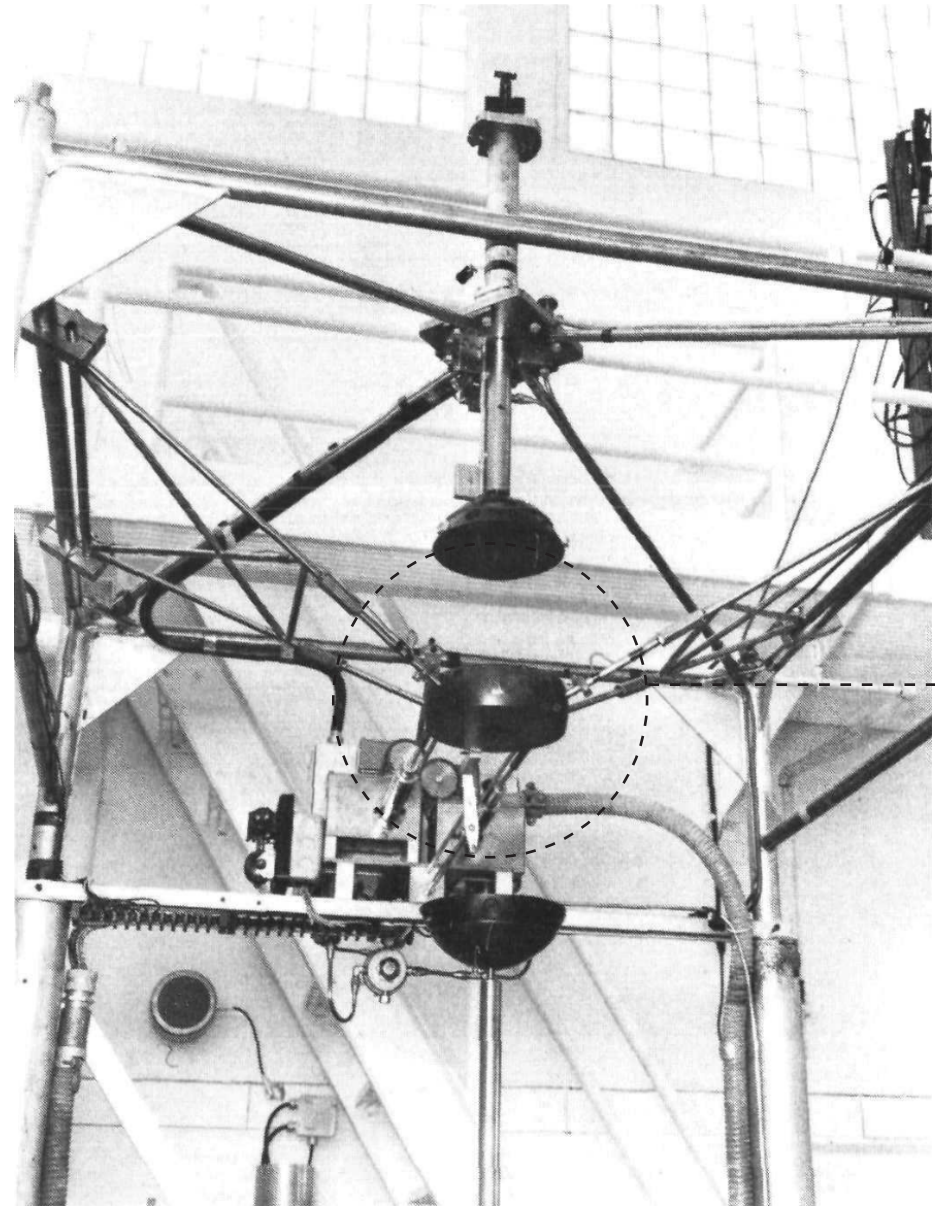


Figure 155: The Godiva device (Myers, 1996).

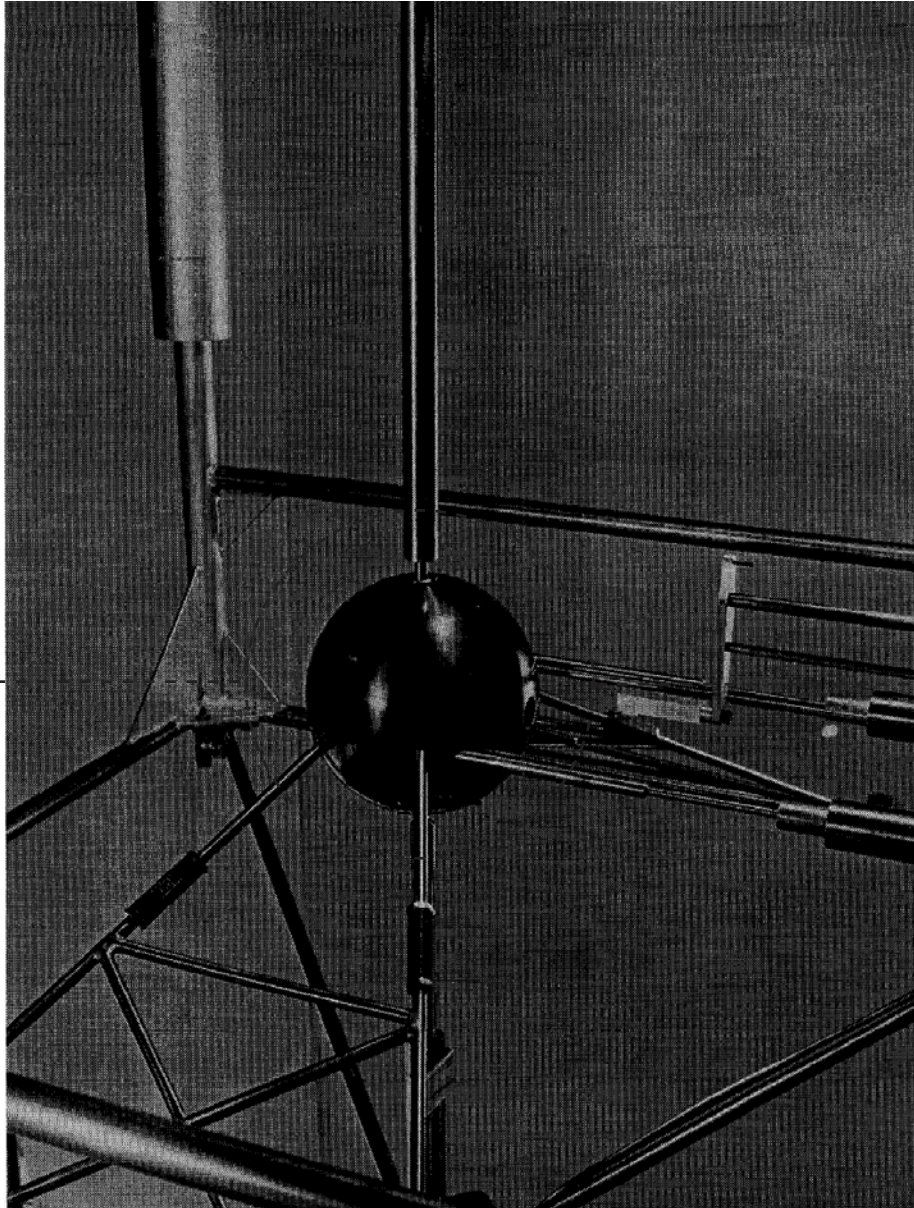


Figure 156: Tectonics of the critical assembly (Myers, 1996).

The structural tectonics of the Godiva series of nuclear devices hold significance in the realm of nuclear physics (Figure 156). This is the 'tickling of the dragons tail', the tempting of terrible fate. While the primary objective in designing these devices is purely functional – to explore criticality, understand nuclear reactions, and harness the power of the atom – there exists an alluring aesthetic and engagement with their form. These intricate constructions represent a marriage between the abstract principles of nuclear physics and the tangible physicality of the devices themselves.

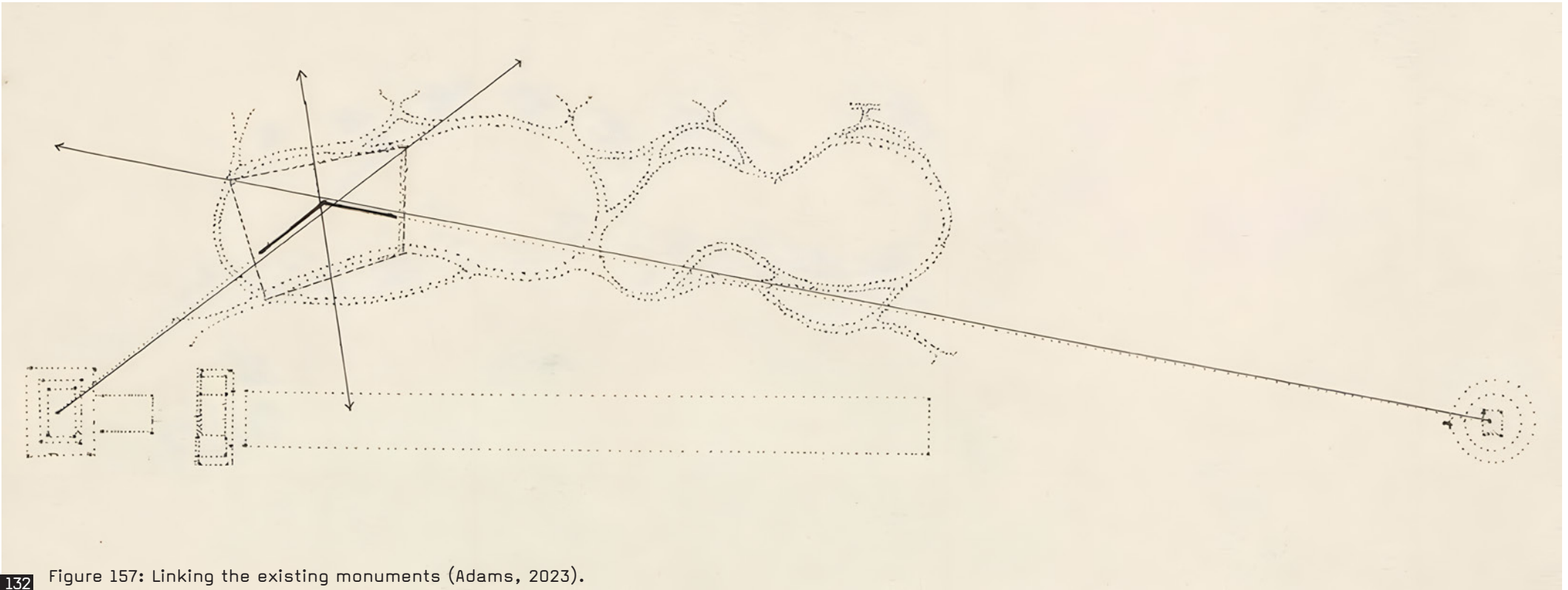
The morphology of the nuclear harks back to the very relationship of matter around it, shaped in its ways to manipulate the matter of the world around us, whether that means to obliterate or harness energy. The shape of these devices represent the core of criticality that they surround. It is a making sense of what was already there and constructing a device around the principle.

THE HEU CORE

7.5 STRUCTURAL PRECEDENT

The Vietnam Veterans Memorial demonstrates a sensitive construction that underpins the core design principles even in the assemblage of the materials. Central to the monument's design are two polished black granite walls, precisely cut to provide a smooth and reflective surface. The meticulous process of inscribing over 58,000 names of fallen soldiers using sandblasting techniques demanded both precision and legibility, resulting in a deeply poignant and readable memorial. The memorial blends architectural precision with symbolism and that is what forms the structure into a place of remembrance (Figure 157). There is a sensitivity of details that provides the space to form place that remembers.

In addition to the aesthetic considerations, the technical design also encompassed the memorial's structural integrity (Figure 158). The foundation, fortified with steel, was engineered to withstand the earth's pressure, ensuring the long-term stability of the memorial. Furthermore, the calculated orientation of the V-shaped walls along an east-west axis, with an angle of 125 degrees, allows the interplay of sunlight and shadows on the engraved names, contributing to the memorial's dynamic and contemplative quality.



132 Figure 157: Linking the existing monuments (Adams, 2023).

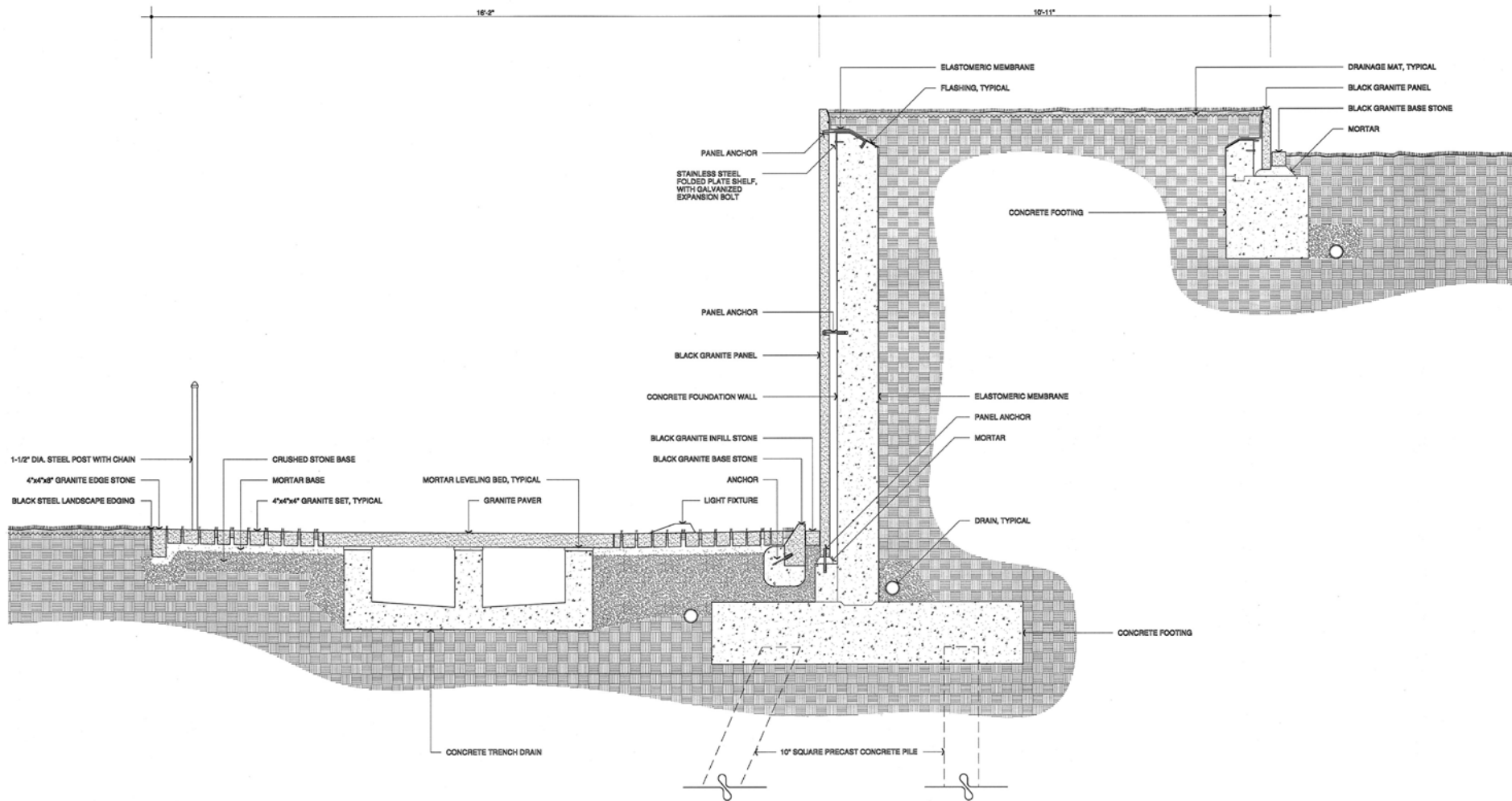


Figure 158: Construction of the scar (Adams, 2023).

7.6 APPLICATION

By working with the precedents and conceptual work established in the previous section of the technical foundational work, the three main considerations of the touchstone stand out. Each becomes a way to propose a technical resolution for design problems.

GROUND RESPONSE

By working intentionally with the earth, the design appears stereotomic to the user. In collaboration with the lighter construction details, this engages one with the underneath, the core of the place. In order to work with the earth by bringing it over structure and digging into it, earth roofs and subterranean construction methods can be applied. Water management and waterproofing are the main issues to resolve with this type of construction.

In general, an earth roof of concrete can be constructed by an insulation layer, waterproofing, drainage layer, a root barrier and the growing medium (Figure 159 and 160). Although this covers a variety of different types of material, this provides the conditions for suitable plant growth on top of structure.

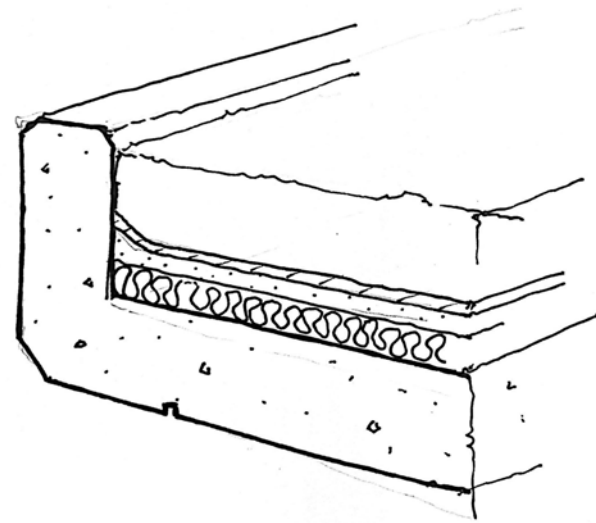


Figure 159: Earth roof construction (author, 2023).

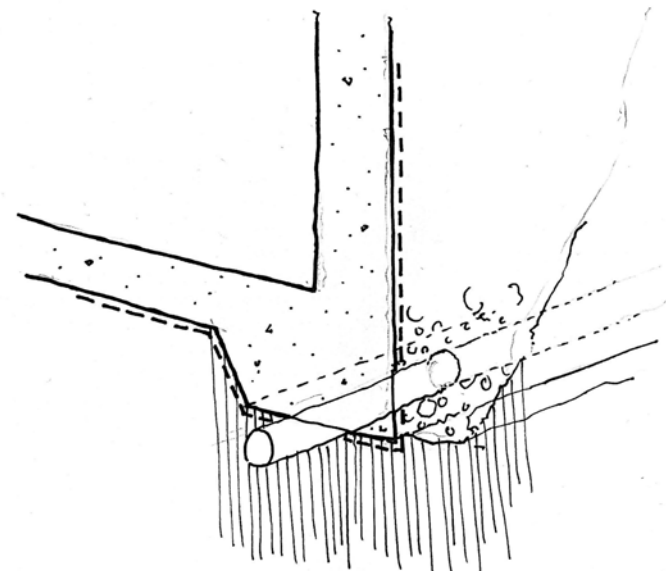


Figure 160: Water drainage (author, 2023).

CONCEALMENT

Concealment and partial reveal of structure works in collaboration with the concept of the ground response and essentially is the outcome of working in and under the earth. The technical outcome of this can be seen in the documentation of the hidden, allowing for drawings to reveal what is hidden (Figure 161).

Obscuring the building through the natural environment reflects the deliberate concealment approach. However, this strategic hiddenness is not absolute, as the design permits certain elements to emerge from beneath the surface and give small reference to what lies beneath the surrounding landscape. As these elements rise in parallel with the natural environment, they offer a controlled and limited glimpse into what remains concealed below, adding an element of intrigue and revelation to the overall design concept.

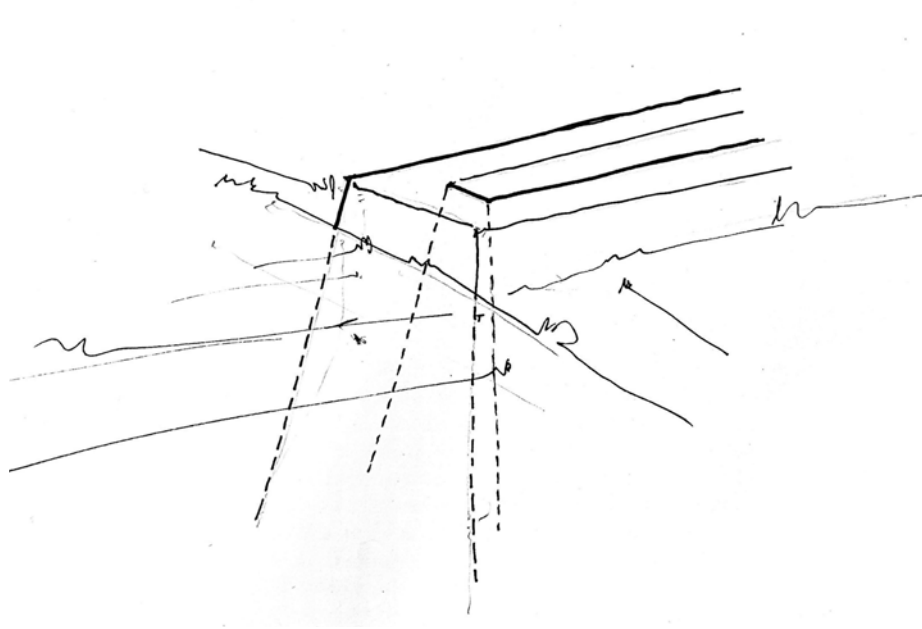


Figure 161: Hidden structure (author, 2023).

CASTINGS

Beyond producing metal in the foundry purely made from melted down firearms, this not only produces a type of 'precious metal' but can be used to produce forms and parts for use in the construction of the design (Figure 162).

In the pursuit of revealing obscurantist elements, there exists a method that involves the utilisation of a specific shape as a means to guide the unveiling process, or triggering memory. This approach hinges on the deliberate incorporation of the firearm receiver from the FN FAL (as discussed in Chapter 5, dark tectonics), a choice that imparts a distinct structural form. This specific form of the firearm acts as a catalyst for recollections. Its presence within the larger context invites exploration, encouraging individuals to delve deeper into the concealed aspects, uncover the underlying narrative, and become the splatterings of the foundry that scatter the site.

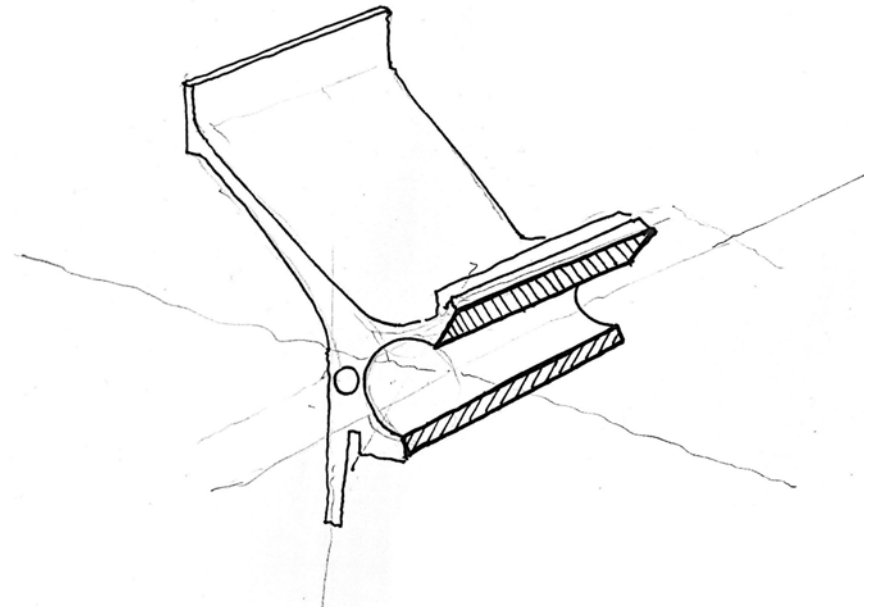


Figure 162: Metal casting (author, 2023).

GROUND RESPONSE

CONCEALMENT

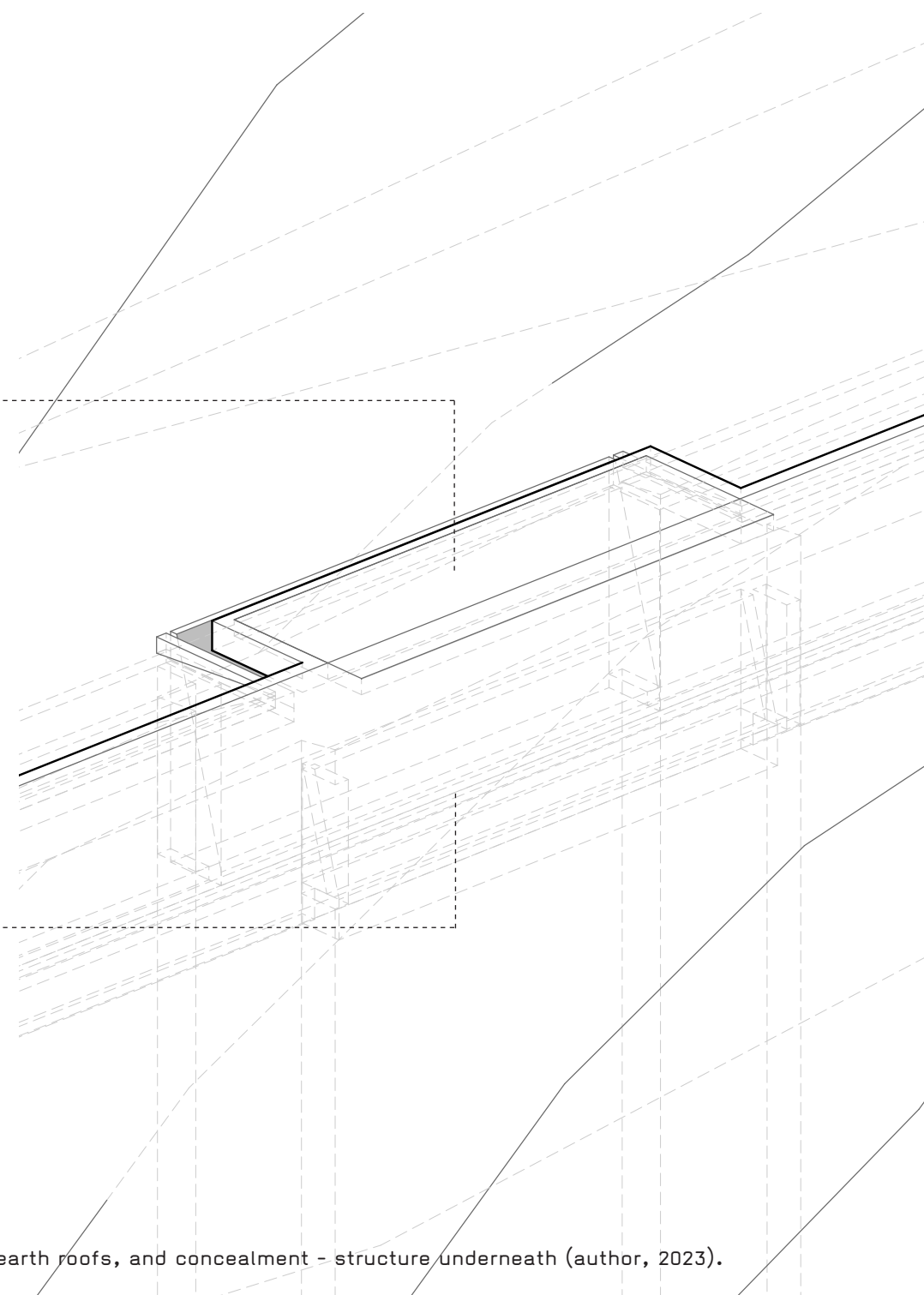
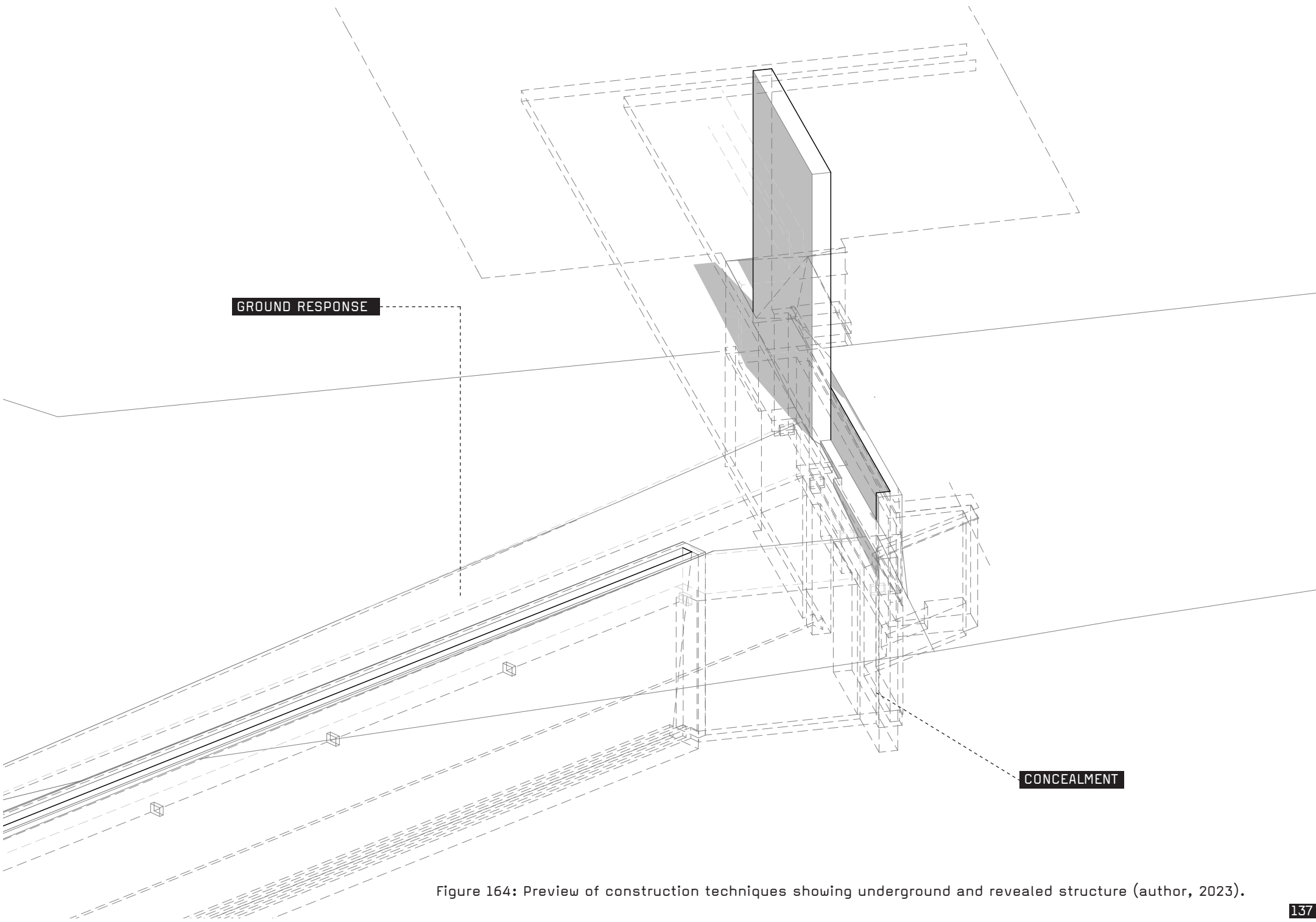


Figure 163: Preview of construction techniques of ground response - earth roofs, and concealment - structure underneath (author, 2023).



GROUND RESPONSE

CONCEALMENT

Figure 164: Preview of construction techniques showing underground and revealed structure (author, 2023).

7.7 CONCLUSION

This chapter focuses on identifying technical conditions of the site and looking at structural precedent to inform design. It commenced by delving into the intricate relationship between the site's natural terrain, landcover, and viewshed densities, recognizing their pivotal role in shaping the architectural response. The touchstone then works on establishing a refined design approach, taking the initial conceptual work and developing it further towards something that can relate to many aspects of the inverted monument. It is within this intersection of considerations that the foundation for the inverted monument's future embodiment takes shape, making a way for a design that is both technically sound and conceptually rich. There is also an attempt to move closer to merging dark tectonics with critical morphology.

The insights established in this chapter make it easier to break into design development (Figure 165-167). The next chapter works on taking all the theoretical and technical considerations made thus far and demonstrating how these affect design and the design outcome.

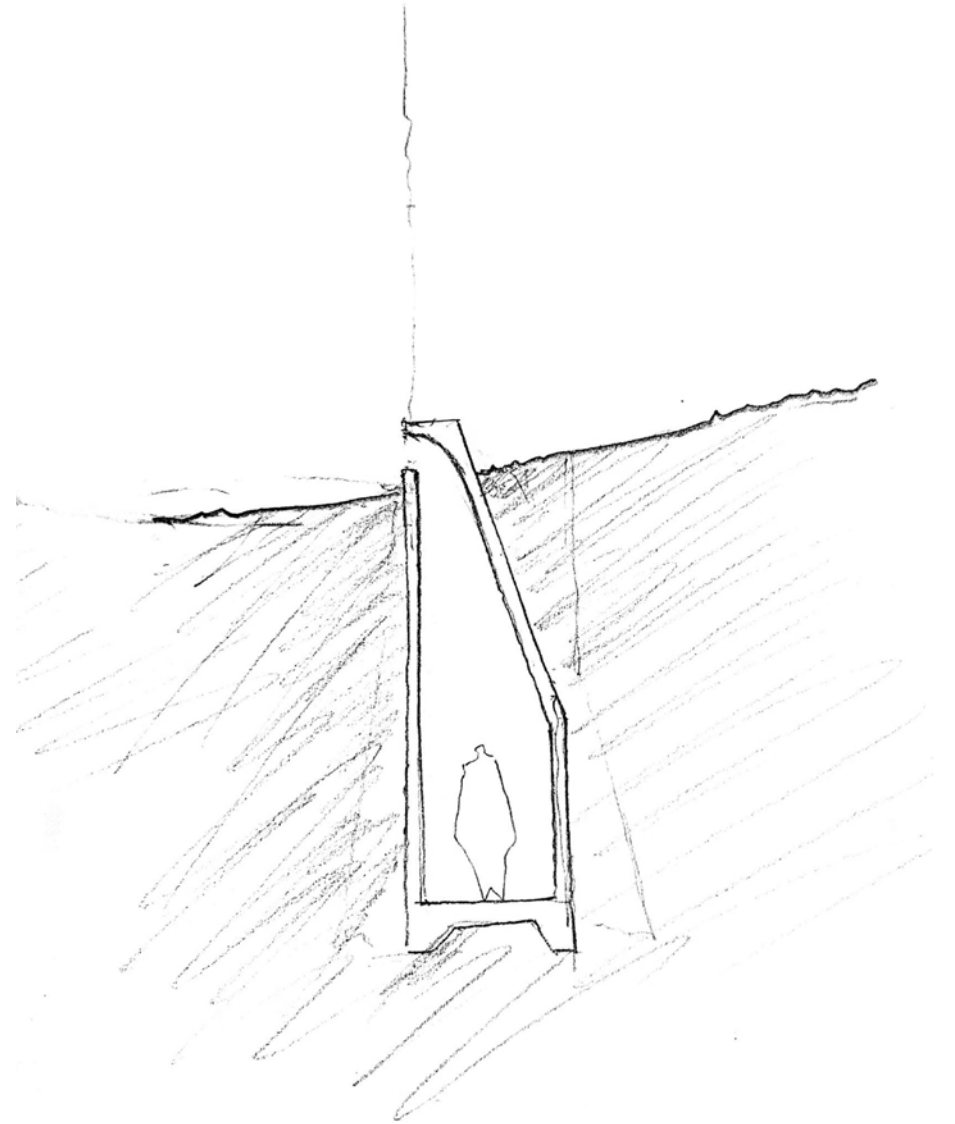


Figure 165: Concealment through the underneath (author, 2023).

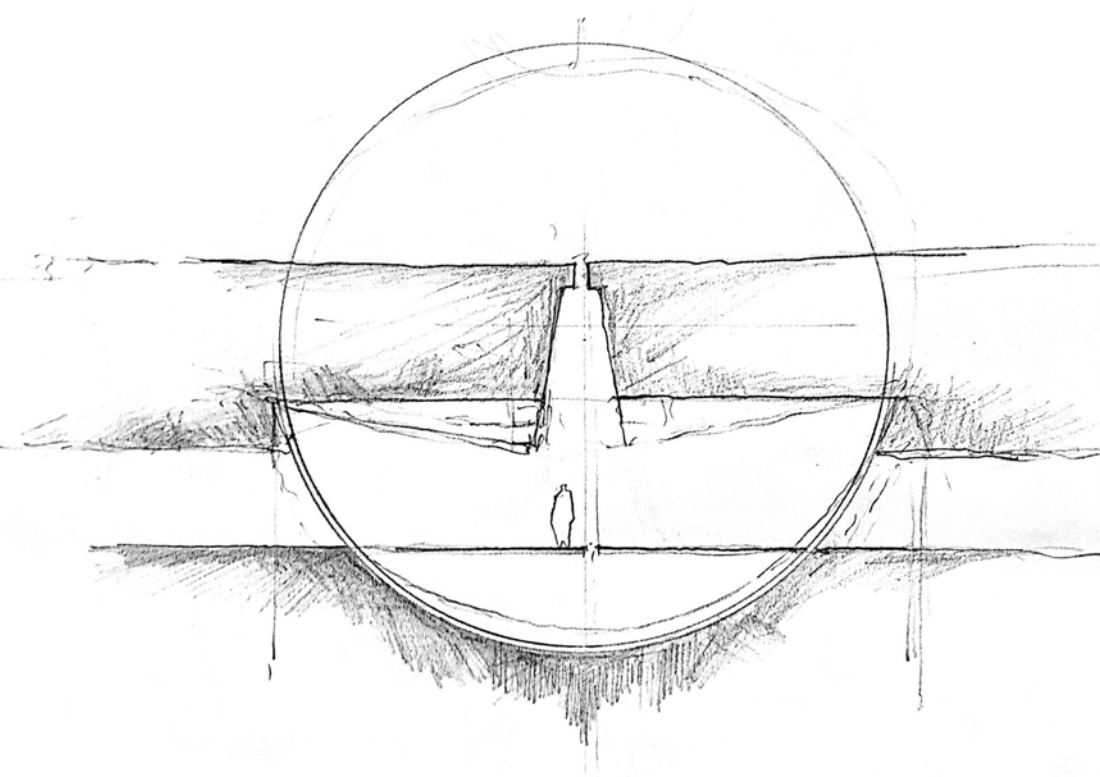


Figure 166: Referencing form through structure (author, 2023).

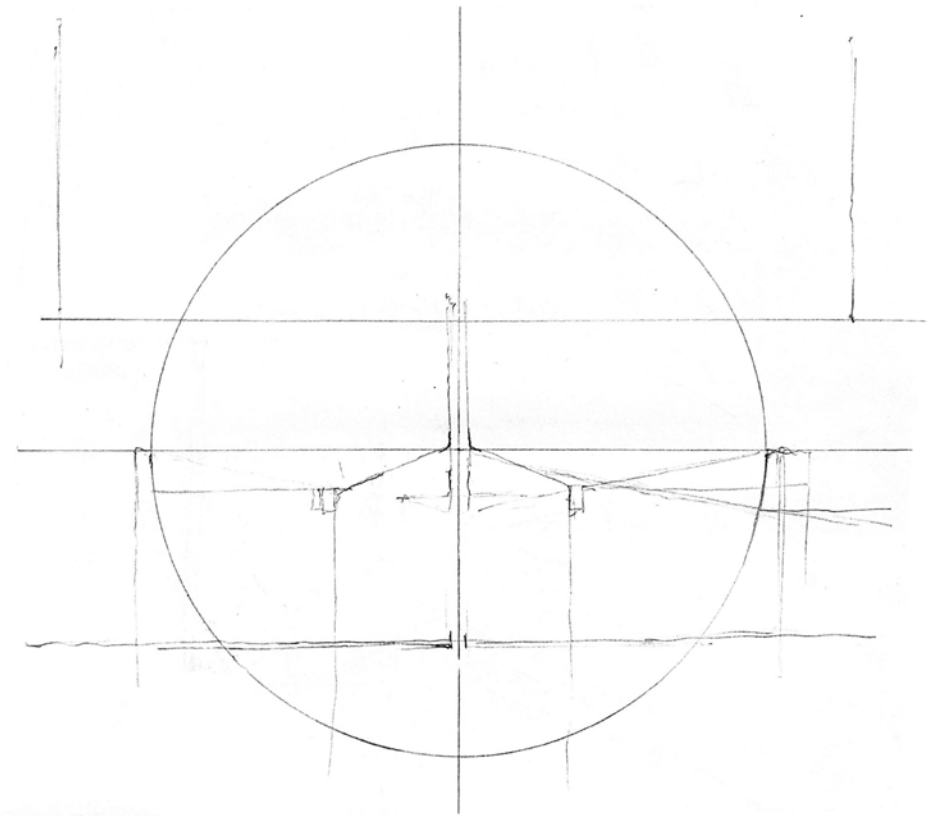
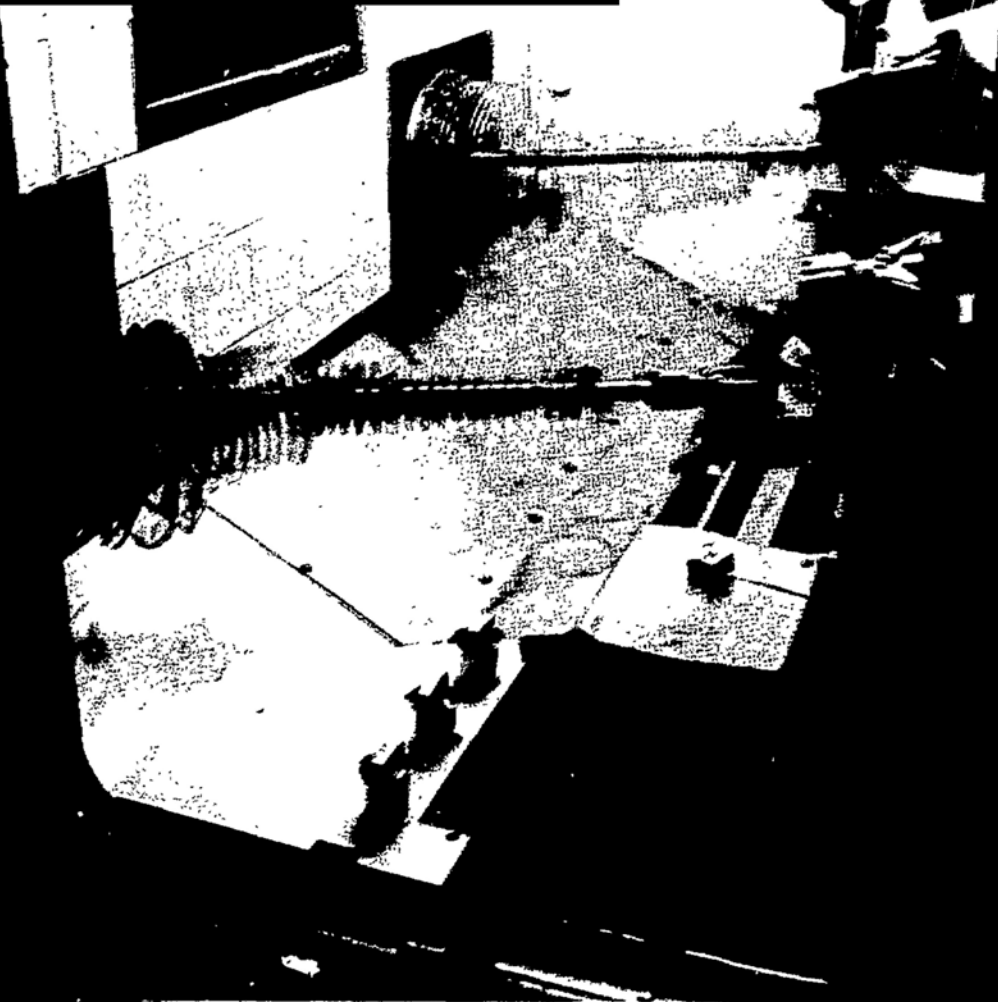


Figure 167: Finding form of the underneath (author, 2023).

CHAPTER

08

DESIGN DEVELOPMENT



8.1 OPENING THE SKETCH BOOK

Now that relevant context and history have been investigated and the groundwork for conceptual reaction has been established, the next step is to lay out the first attempt at formulating an architectural language. The textual vocabulary of this thesis has already been designed and rolled out for the document; the architectural vocabulary is disclosed as the pen moves over paper.

Even though it is presented with theoretical and precedent analysis first, the design process actually developed over time alongside the theory. As one grows, so does the other. The main gist of this section is how the architecture responds to the existing in its infancy, as these gestures determine how decisions are made later on.

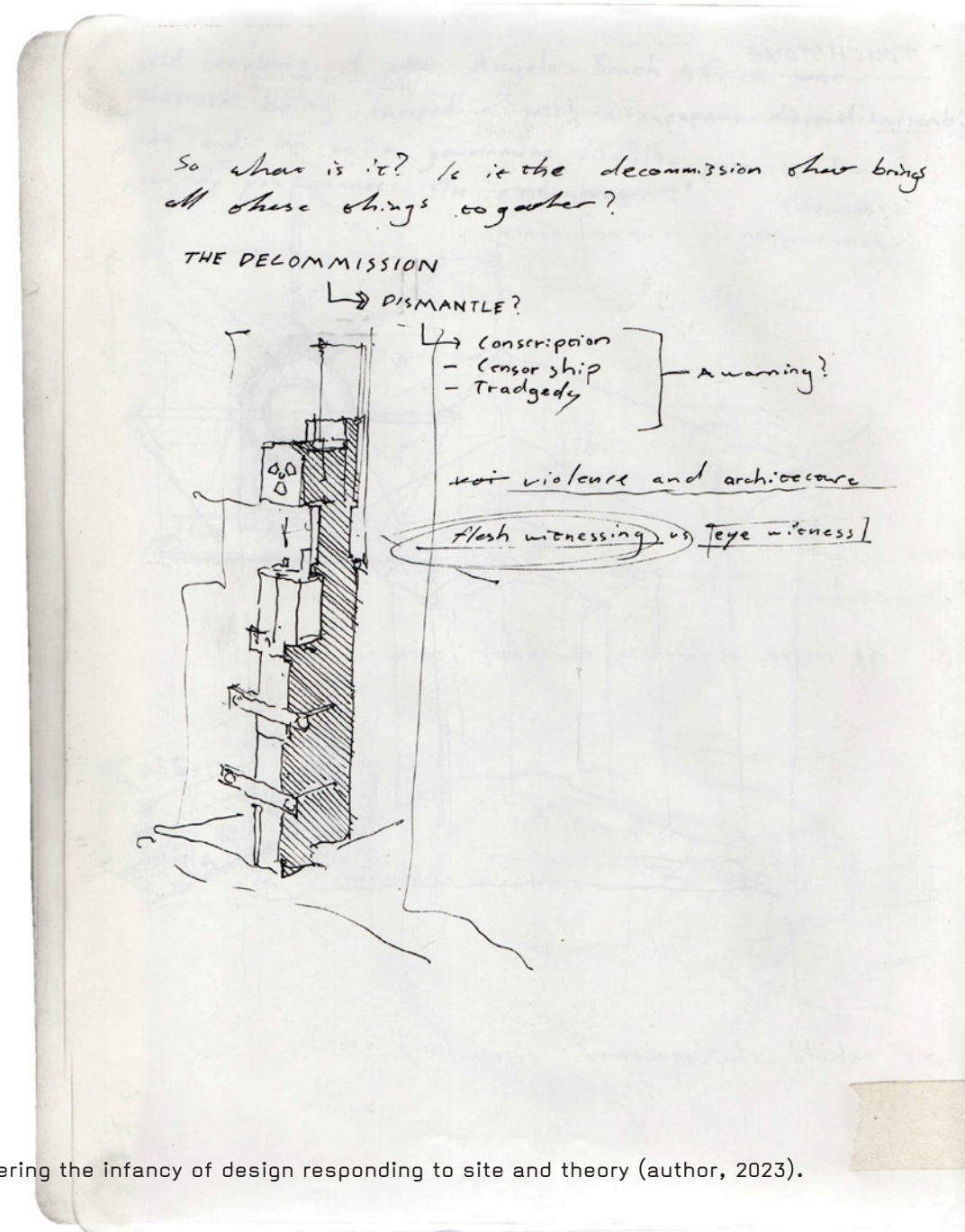
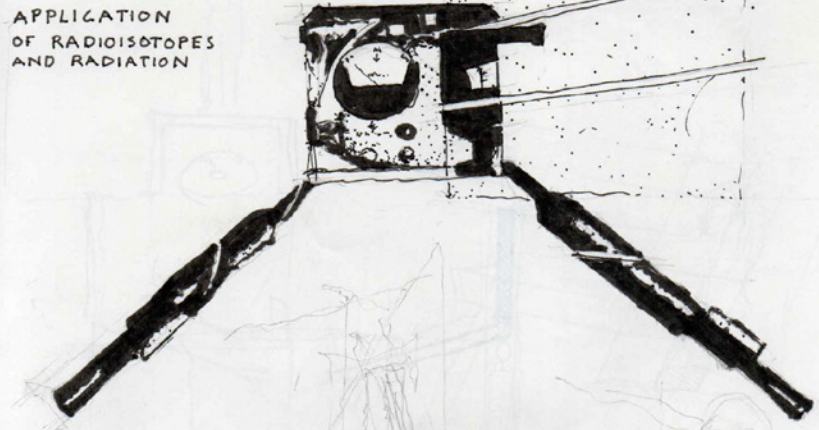


Figure 169: Entering the infancy of design responding to site and theory (author, 2023).

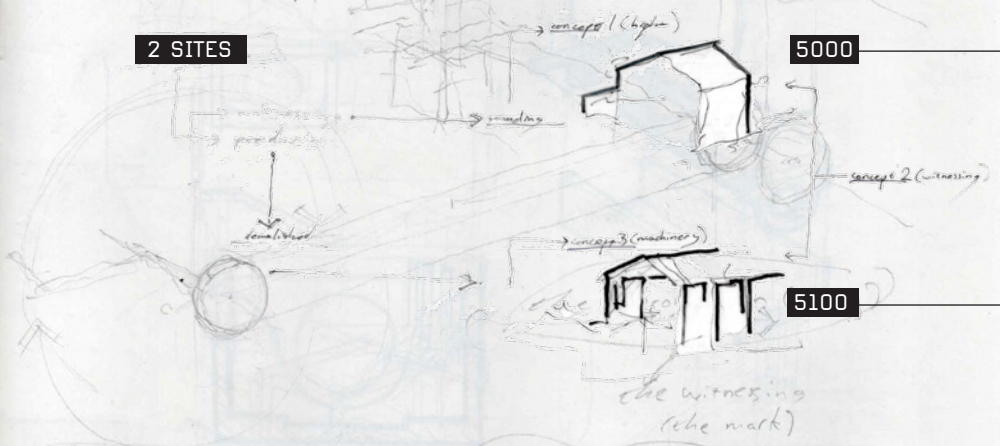
APPLICATION
OF RADIOISOTOPES
AND RADIATION



2 SITES

5000

5100



Flesh-witnessing to the decay and decommission

structure → decommissioned → wax melted

→ melt something to leave permanent mark

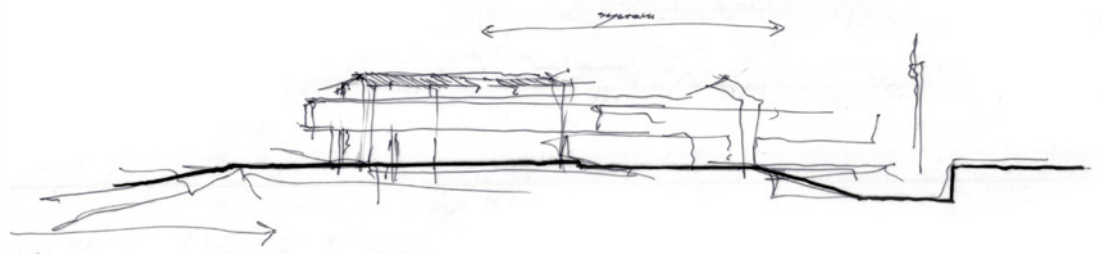
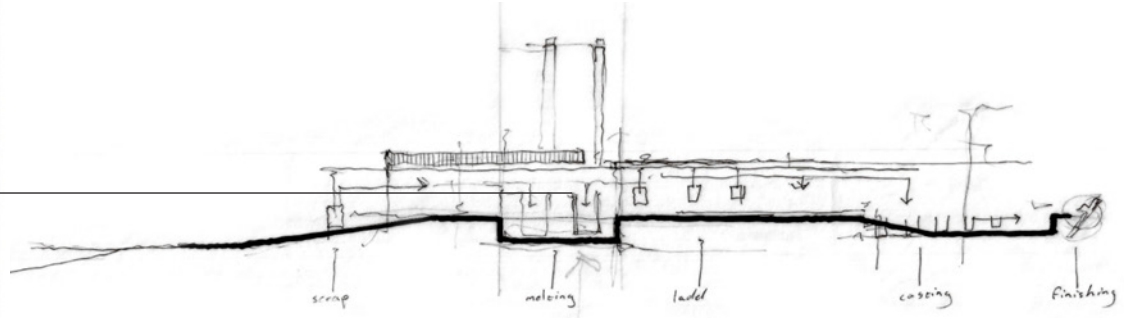
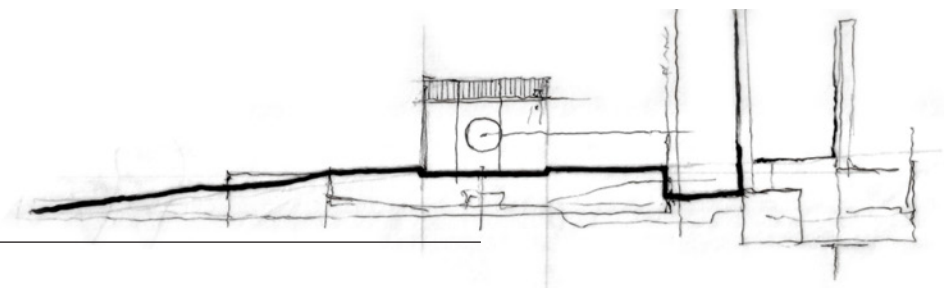
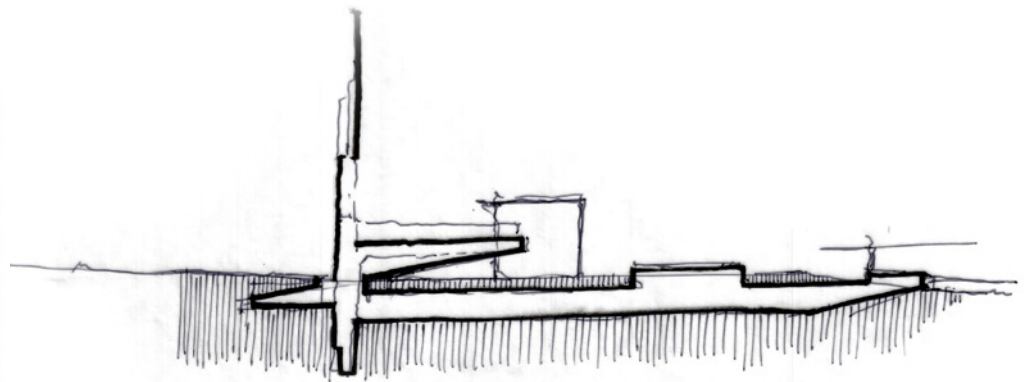


Figure 170: Finding ways through which new responds on elevation (author, 2023).

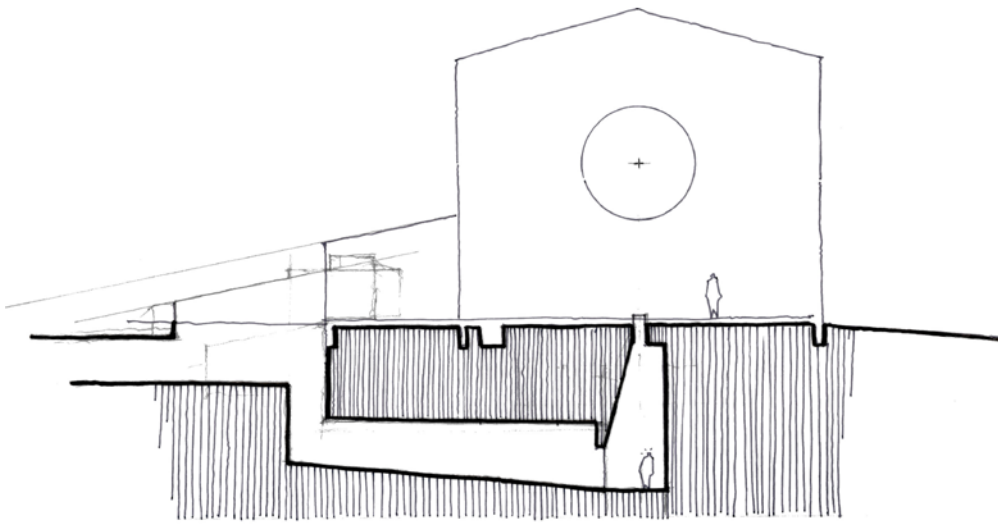


Figure 171: Finding ways to respond underneath (author, 2023).

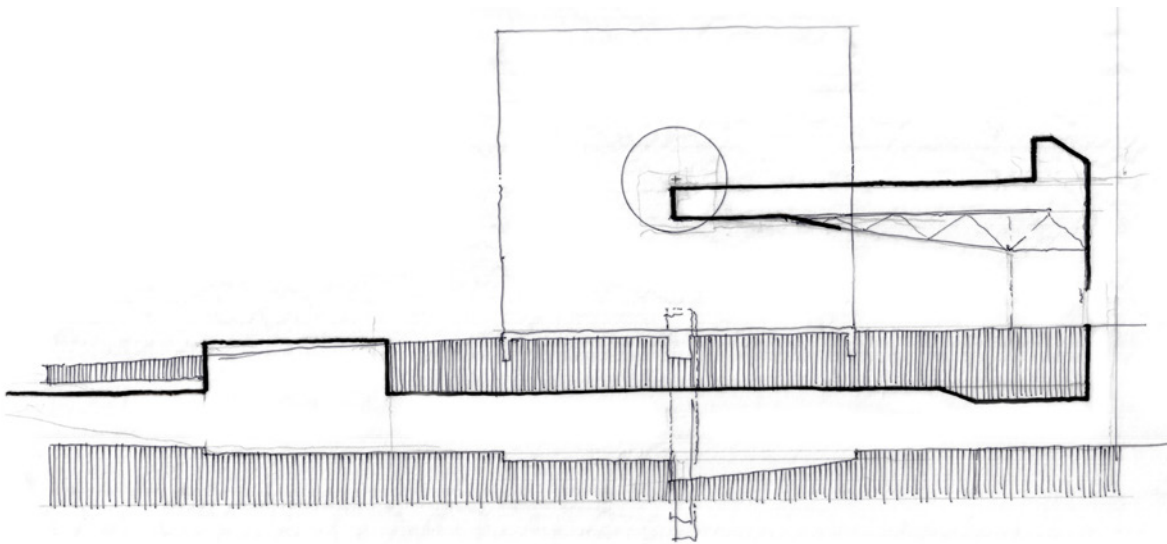


Figure 172: Exploring ways through which new responds on elevation (author, 2023).

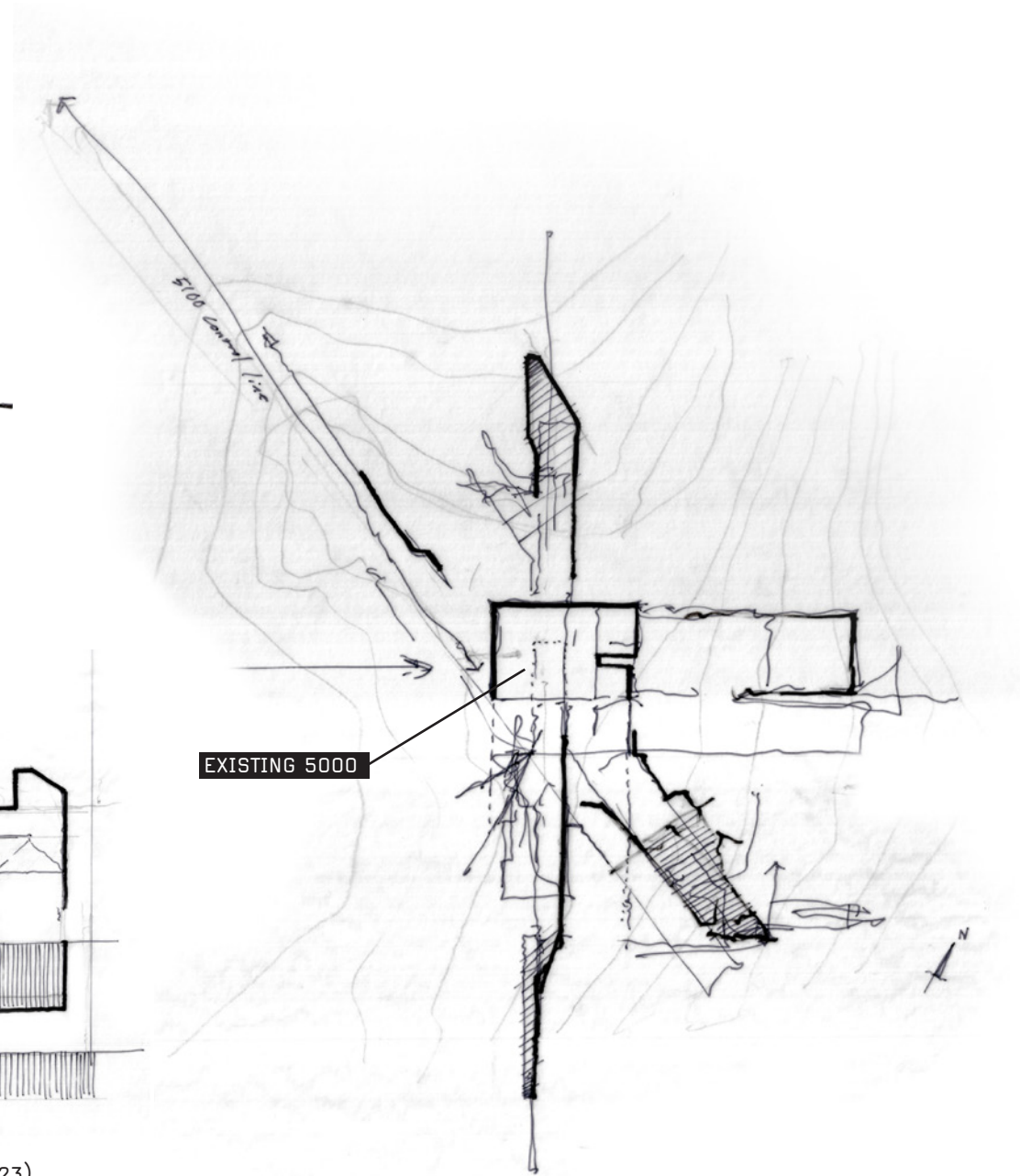


Figure 173: Parti diagram of building 5000 (author, 2023).

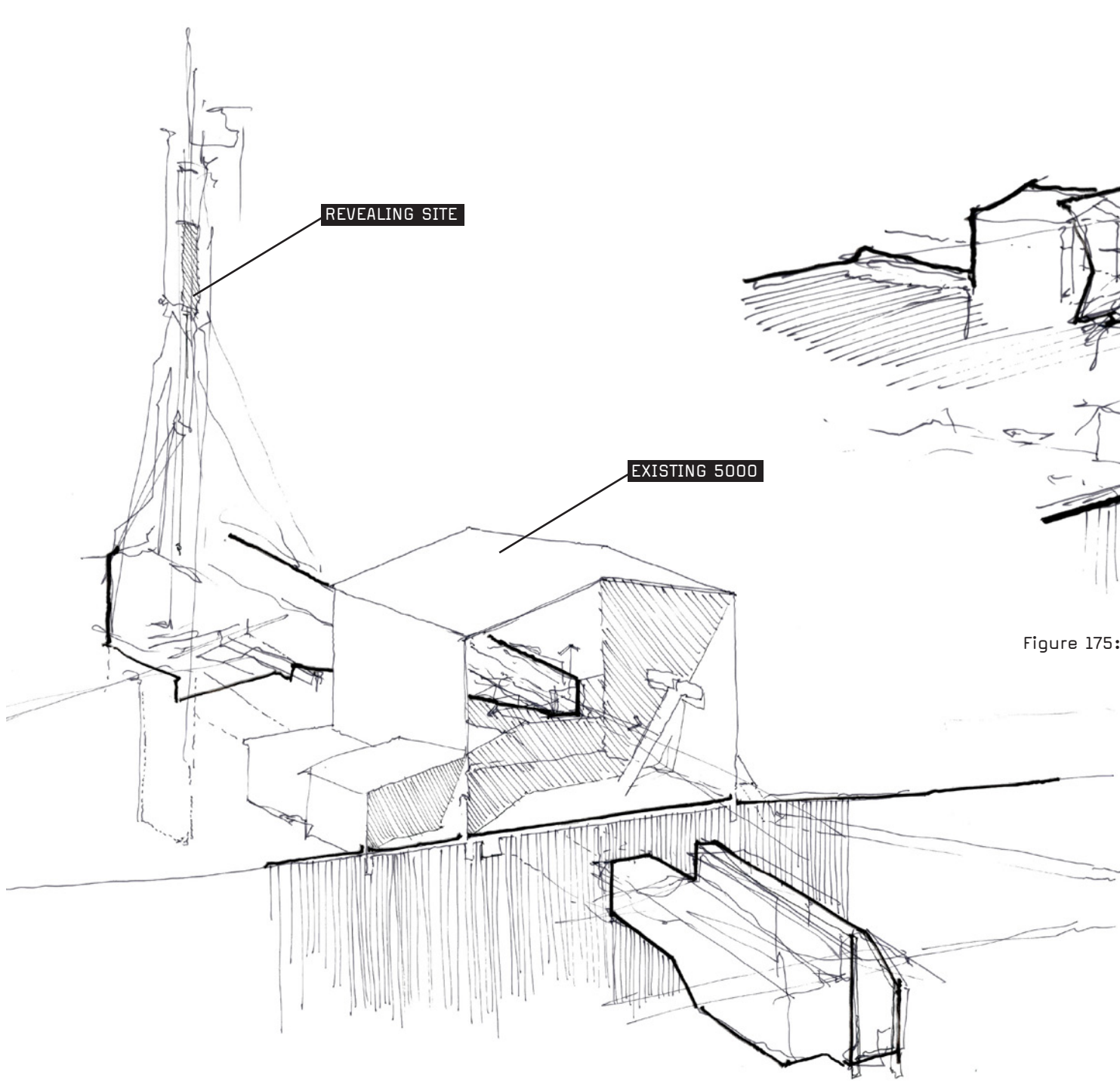


Figure 174: Entering the underground and establishing relationship to the existing structure (author, 2023).

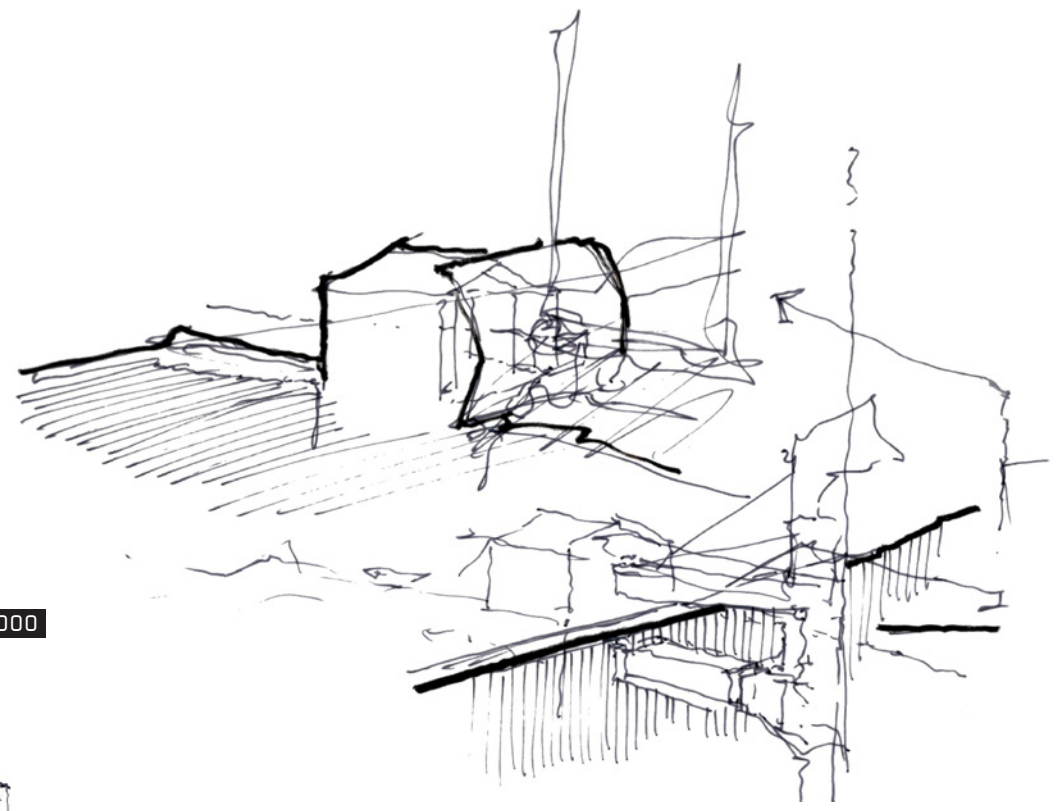


Figure 175: Reacting to the existing (author, 2023).

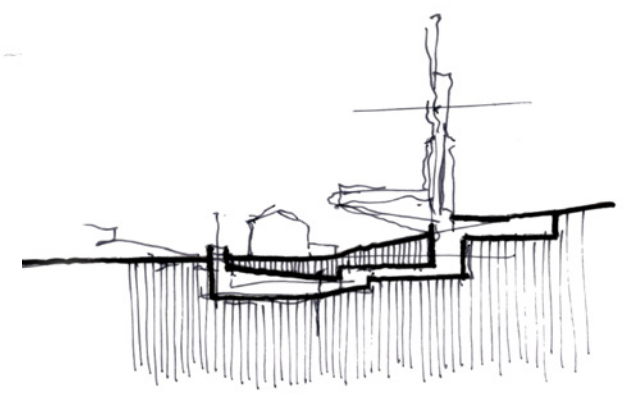


Figure 176: Underneath and over (author, 2023).

5100

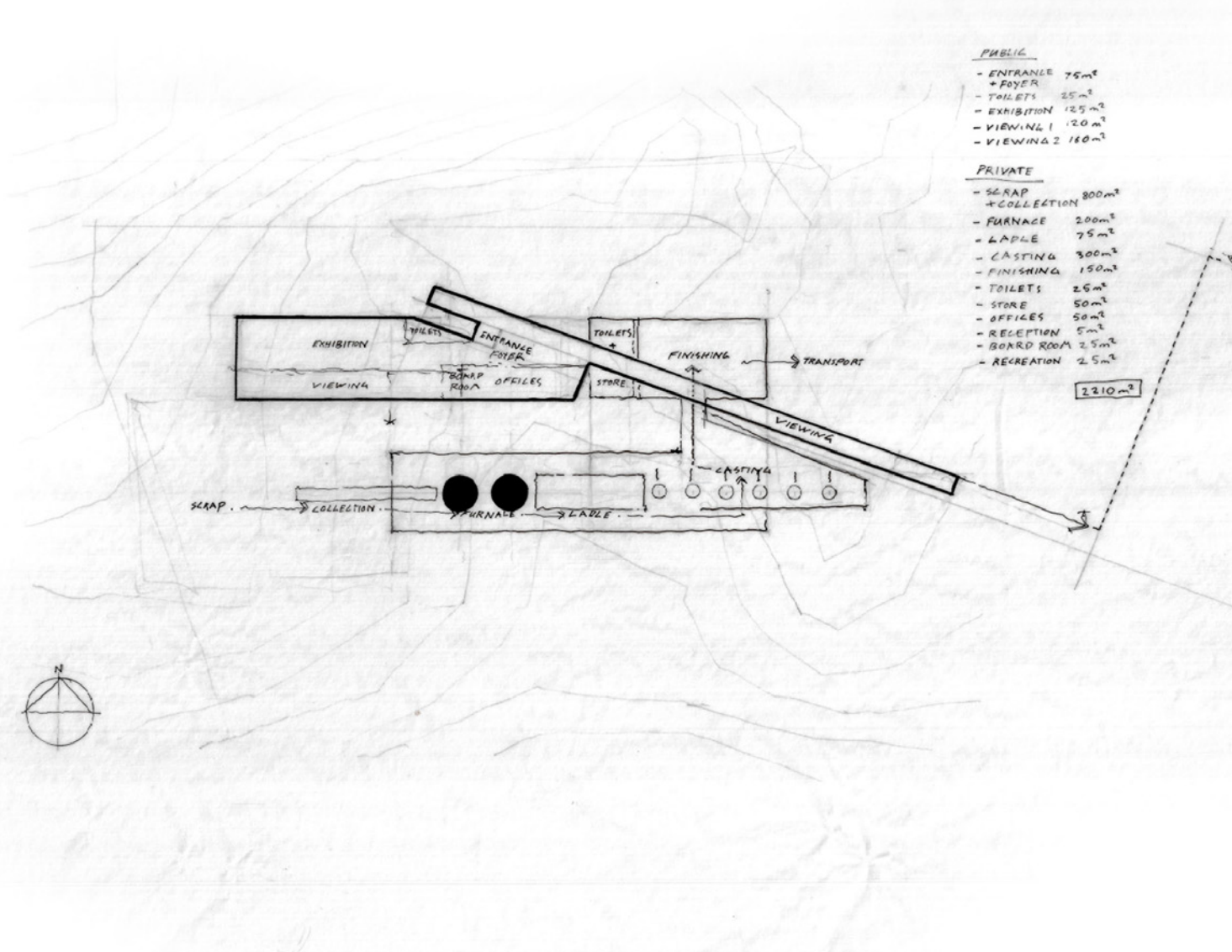
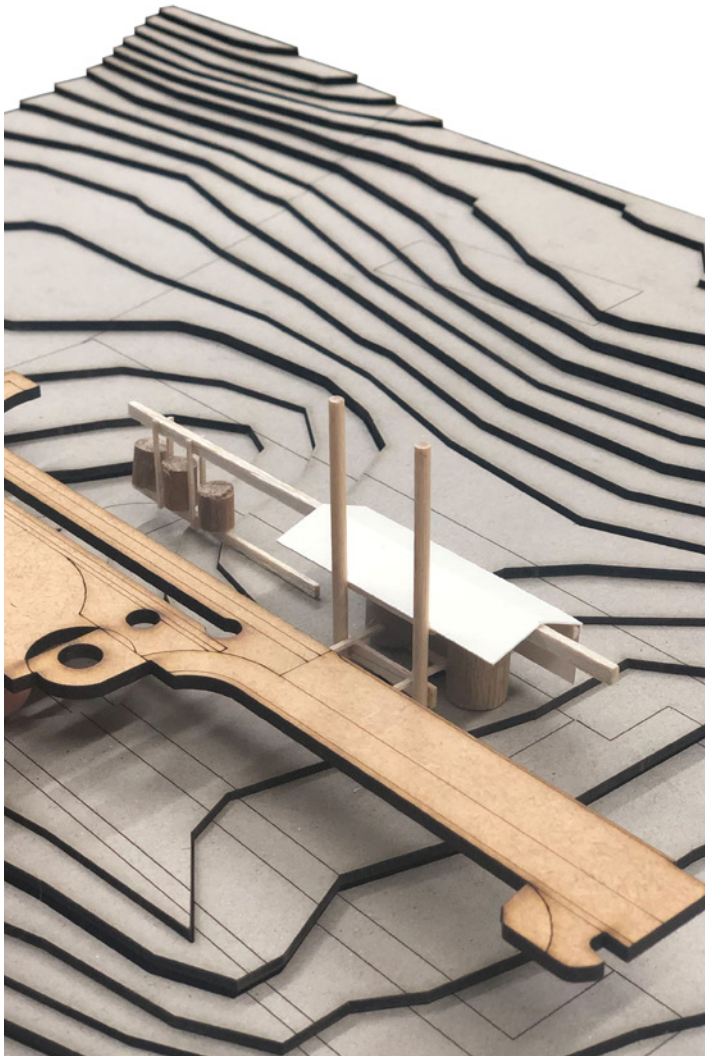


Figure 178: First massing in context for 5100 (author, 2023).

5000

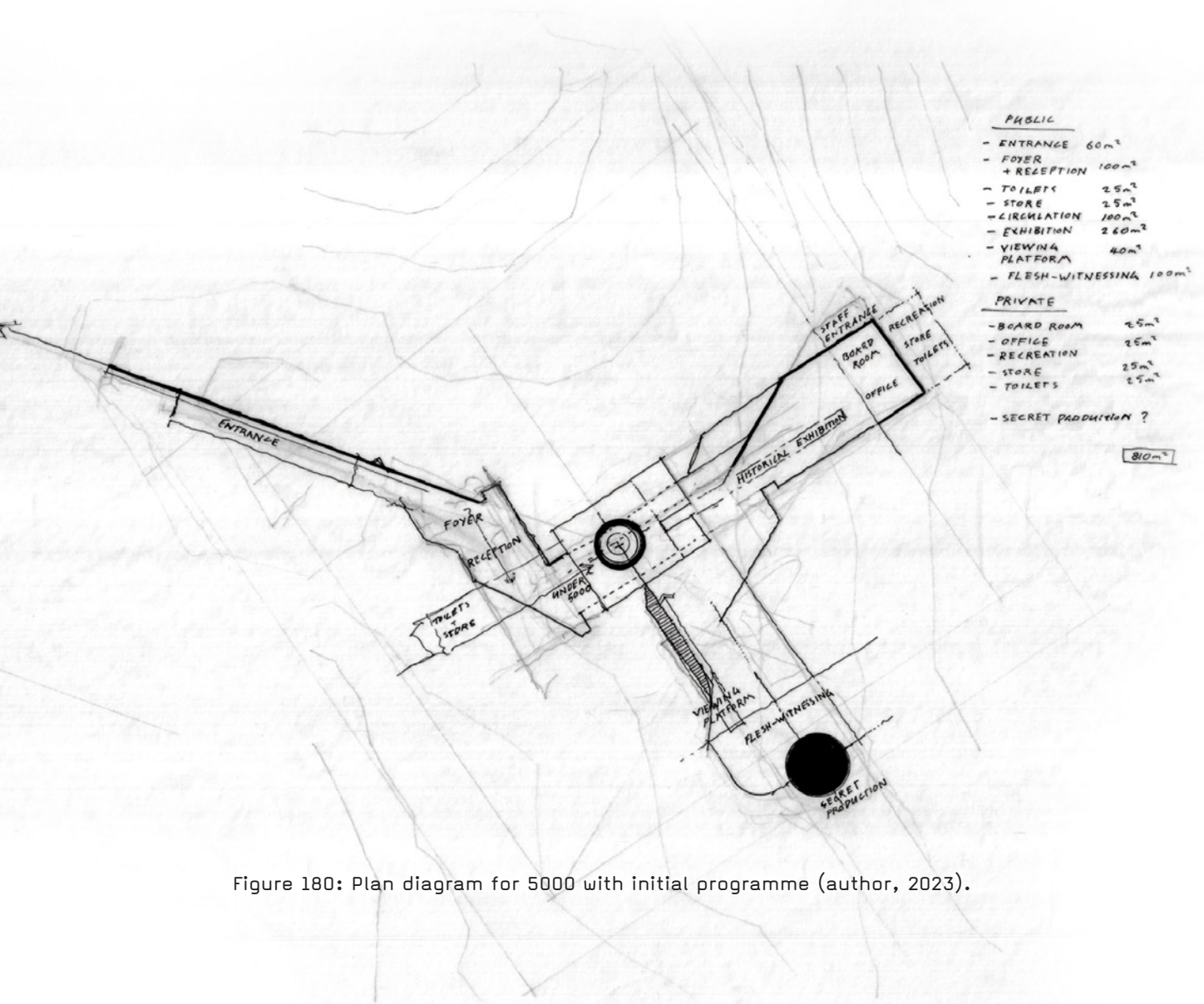
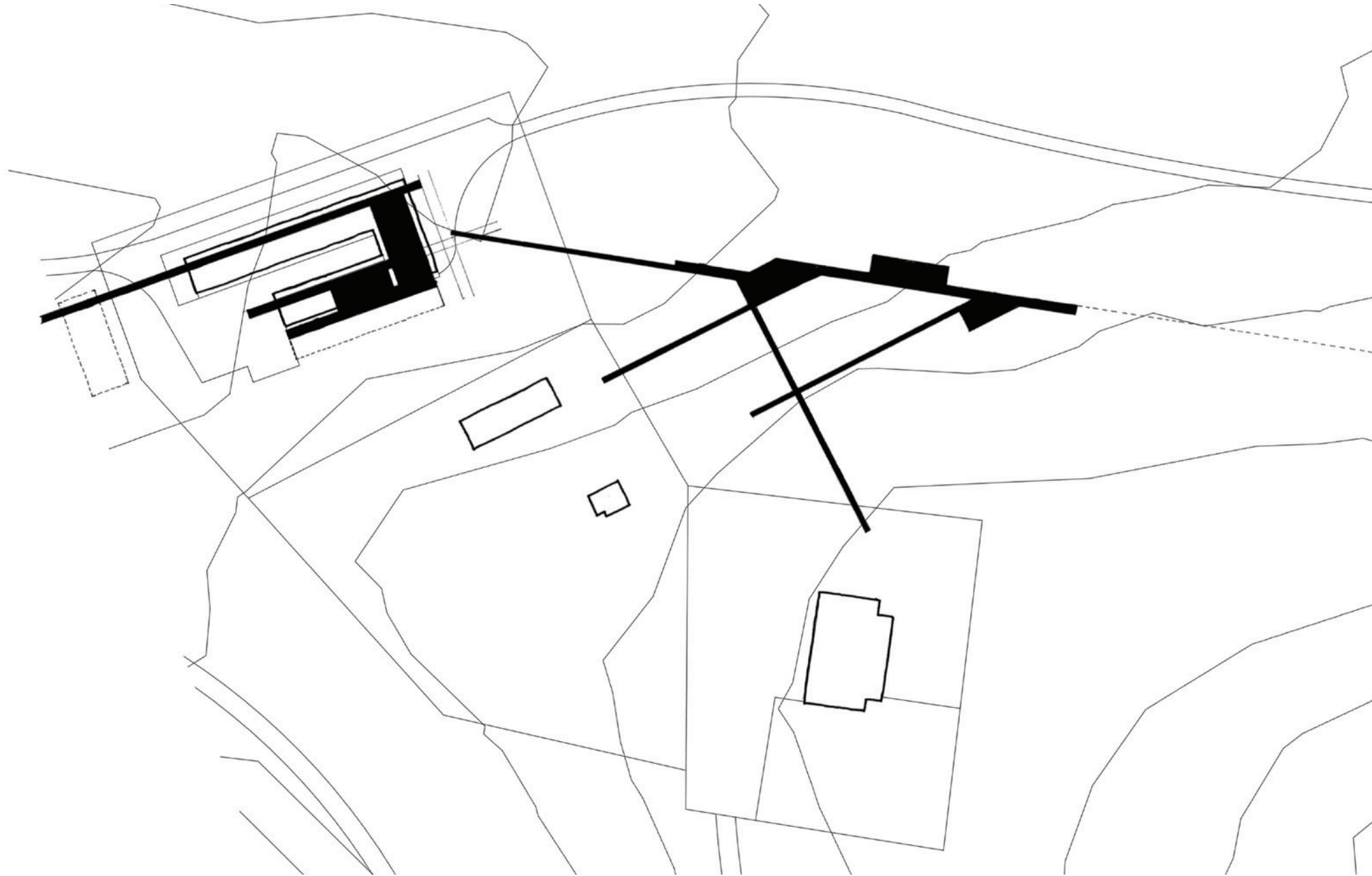


Figure 180: Plan diagram for 5000 with initial programme (author, 2023).



Figure 181: First massing in context for 5000 (author, 2023).



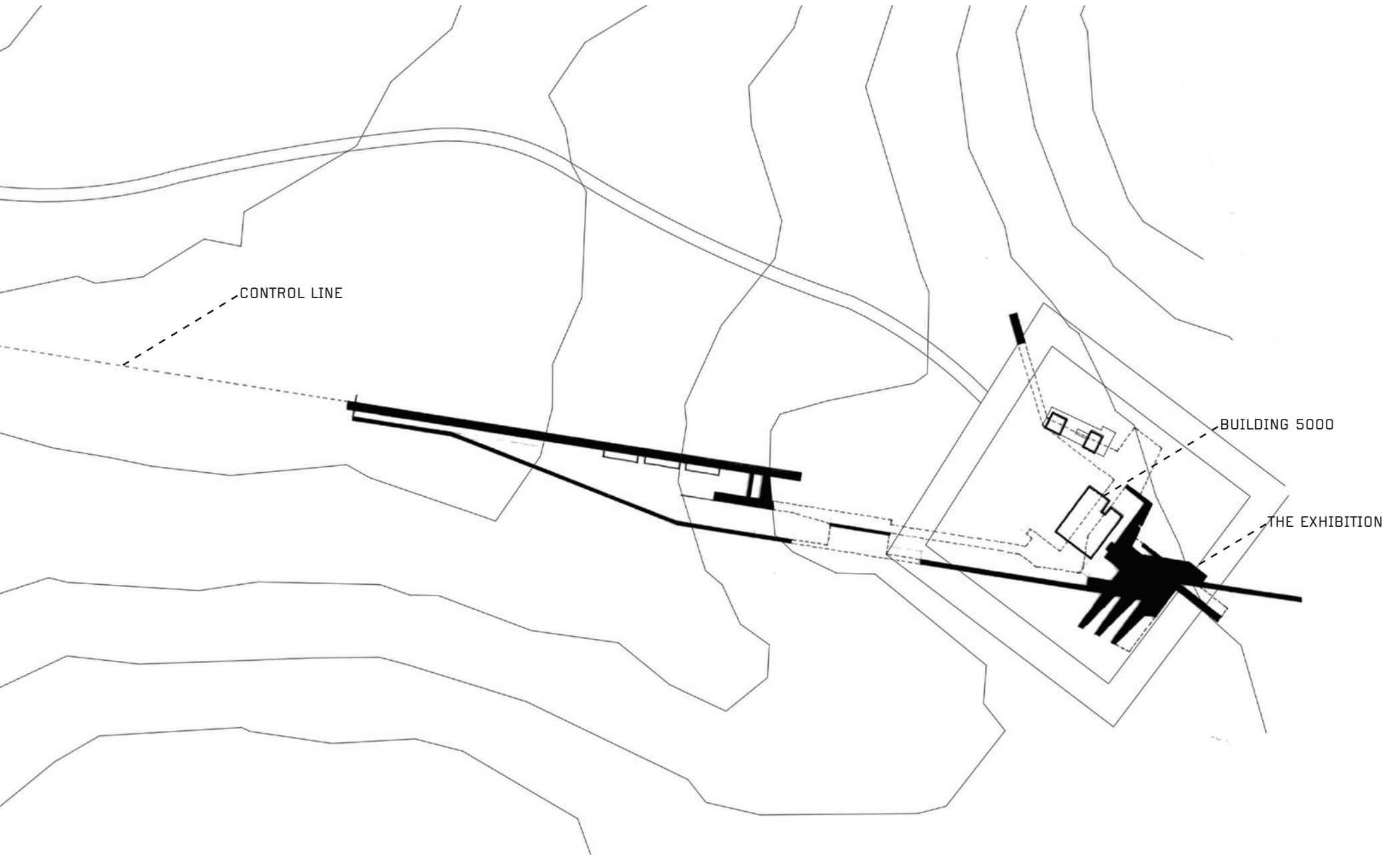


Figure 182: Basis for design on a large scale, how the two buildings interact (author, 2023).

8.2 REFINING THE DESIGN

Working on the design further takes the initial architectural response and refines the reasons for why the building should form the way it has. This section of design development captures key moments of architecture that become relevant to the final — they are each saying something different that developed the final design further along. Progress is made from now from a combination of hand drawings, computer renders and physical models.

One of the main considerations at this stage is finding a narrative for the pathway that would connect the buildings and join with the theory.

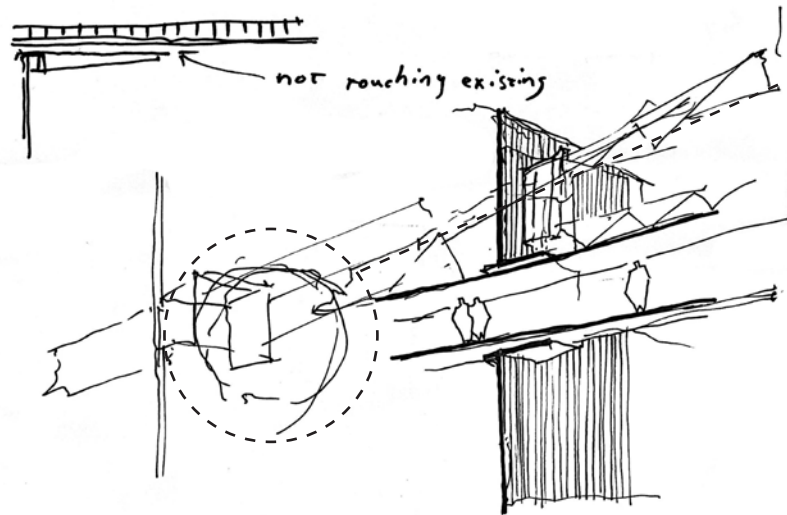


Figure 183: Experiencing the existing (author, 2023).



Figure 184: Referencing critical morphology, building 5000 (author, 2023).

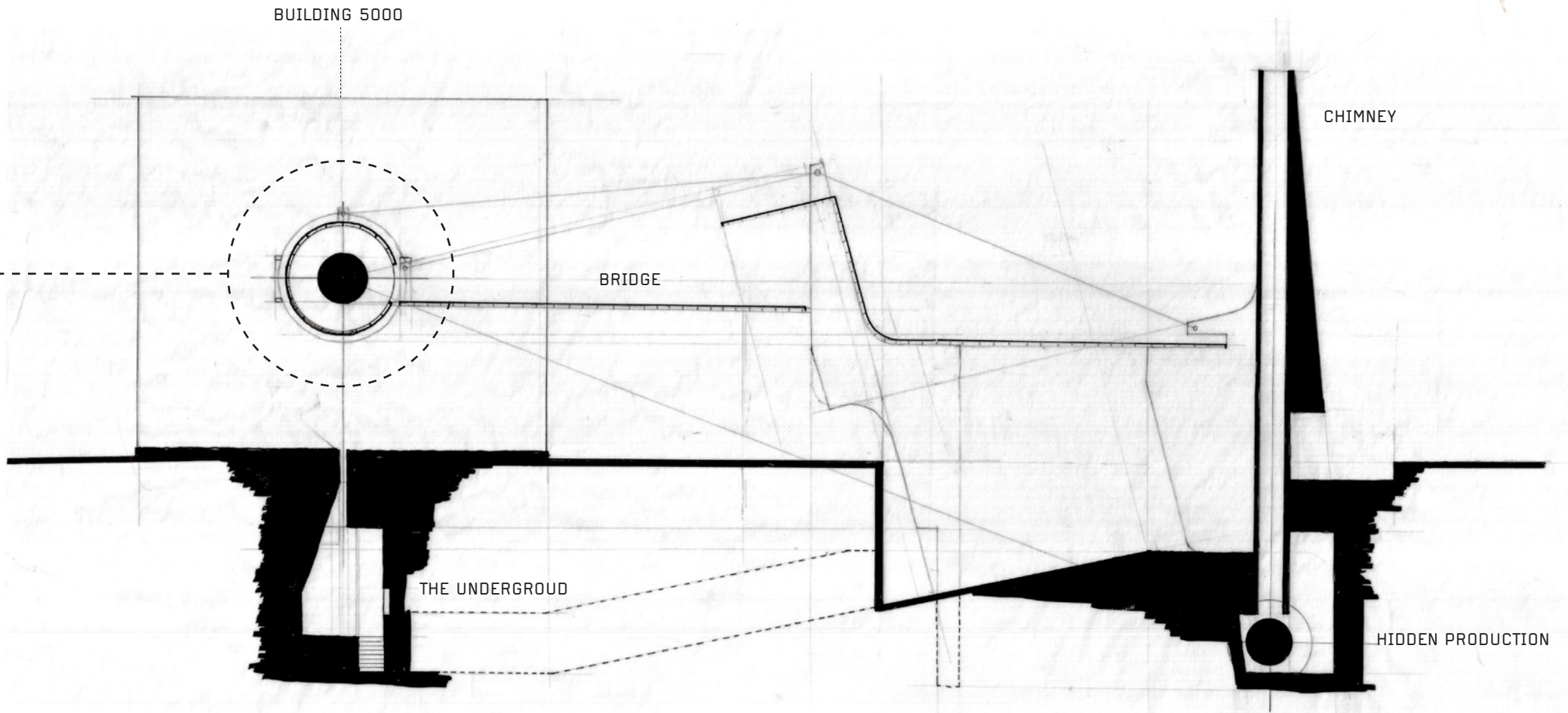


Figure 185: Developing the underground and concealing the production on section at building 5000 (author, 2023).

5100

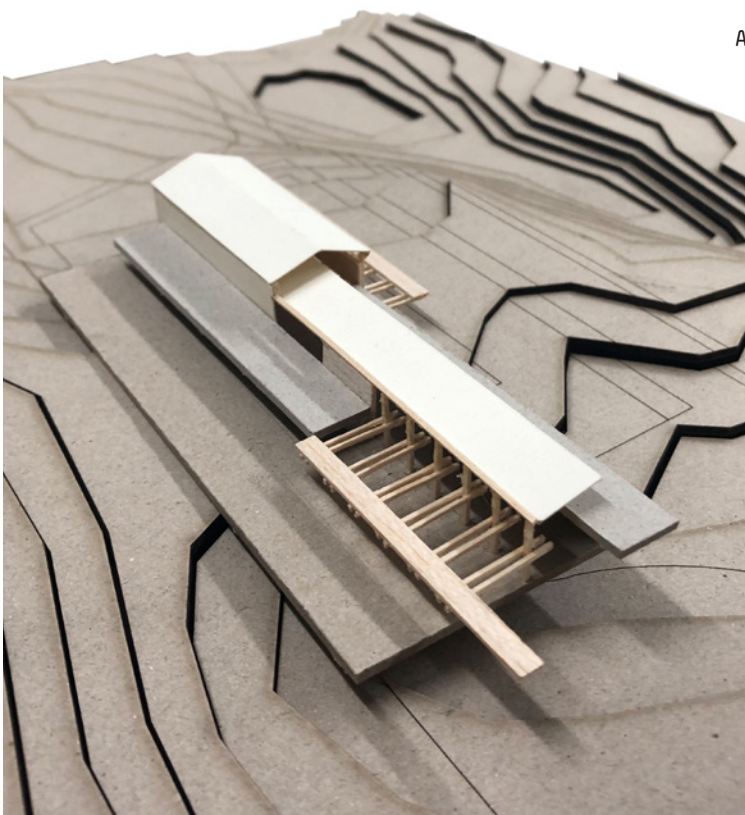


Figure 186: Massing in context for 5100 (author, 2023).

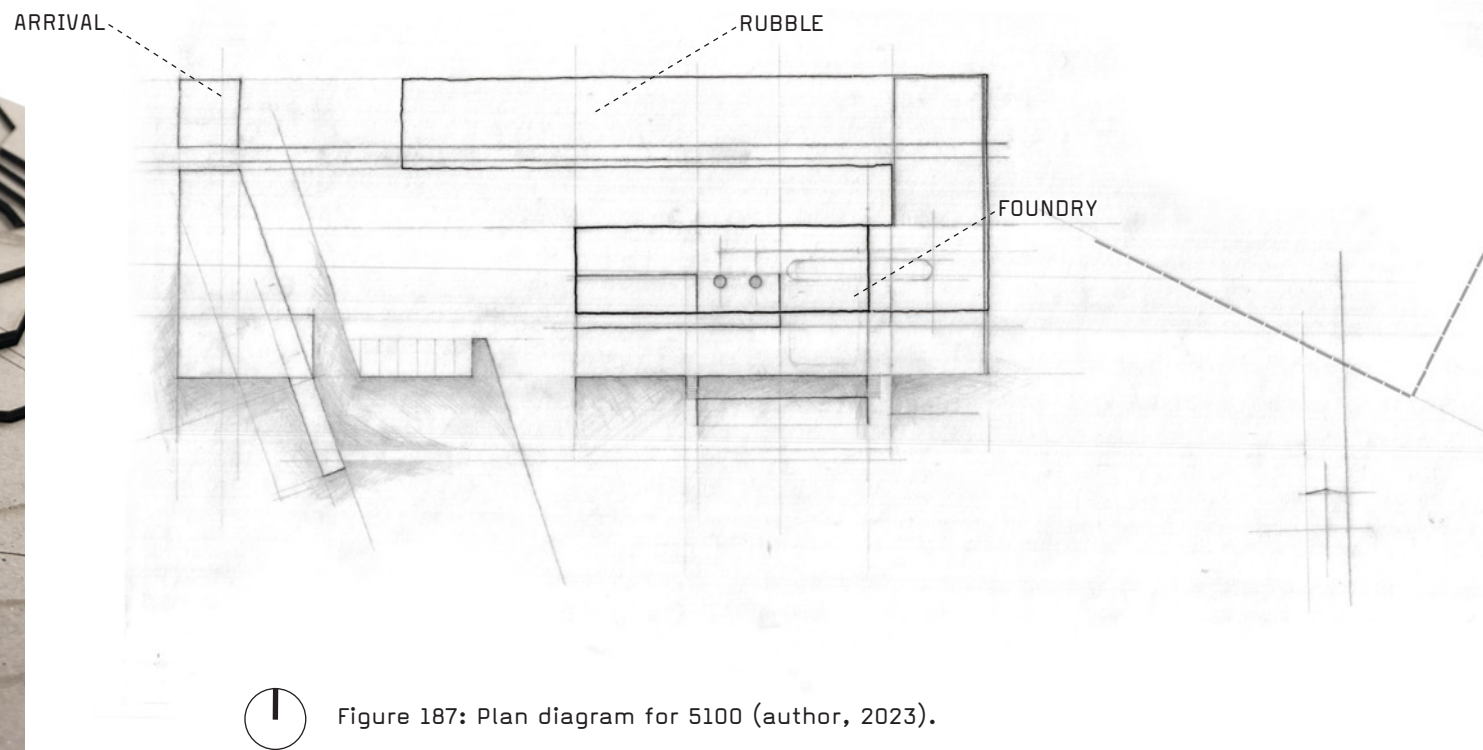


Figure 187: Plan diagram for 5100 (author, 2023).

5000

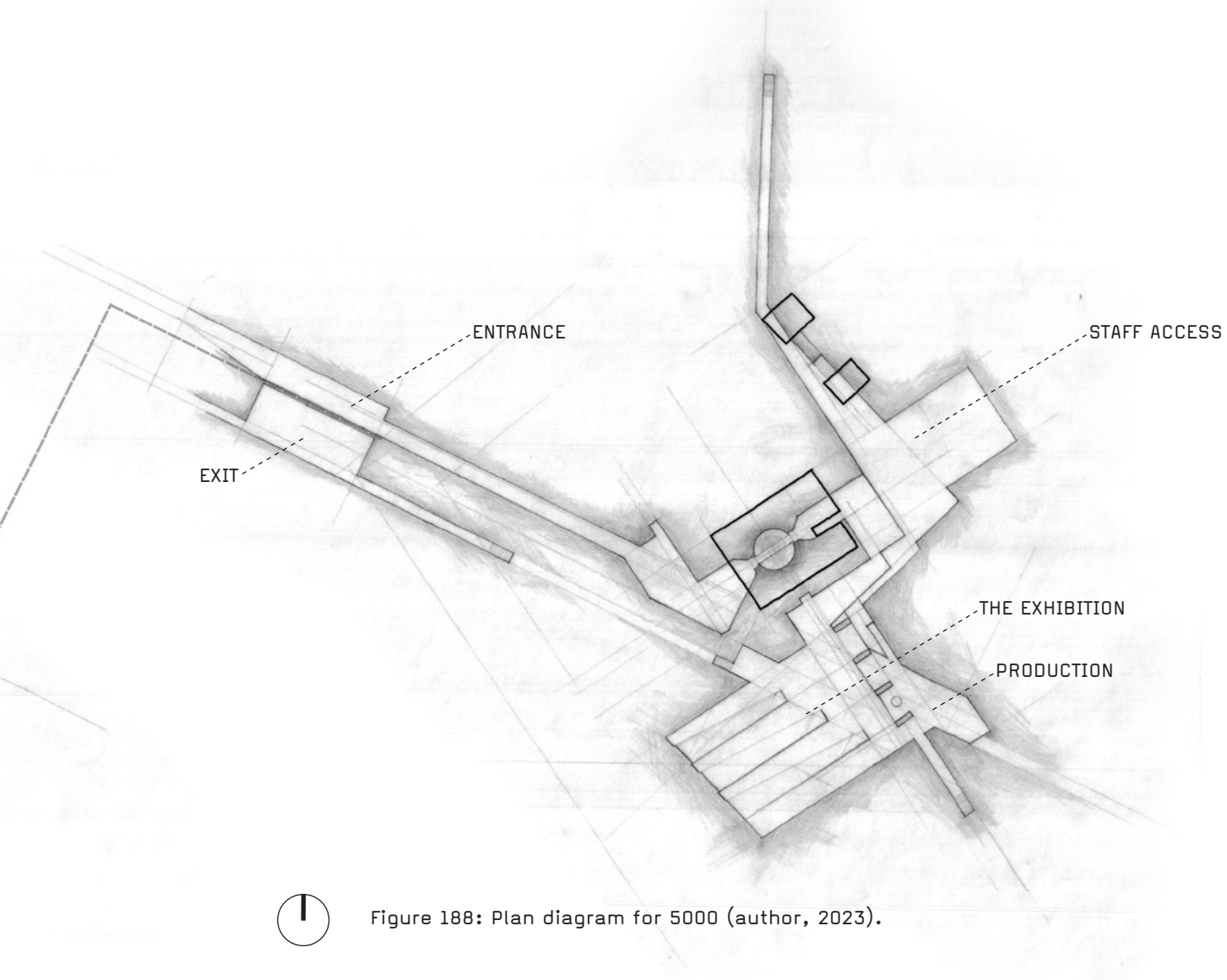


Figure 188: Plan diagram for 5000 (author, 2023).

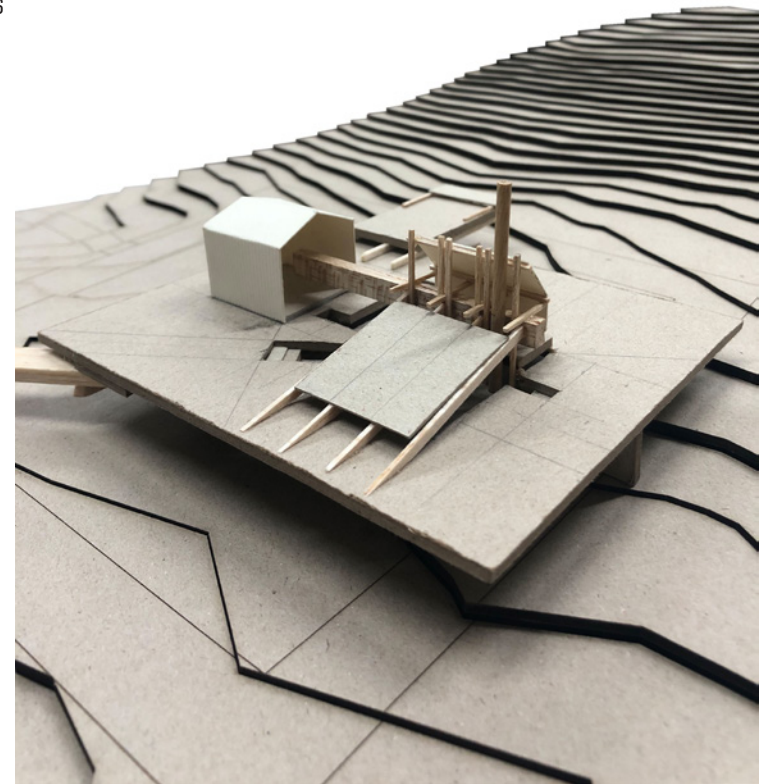
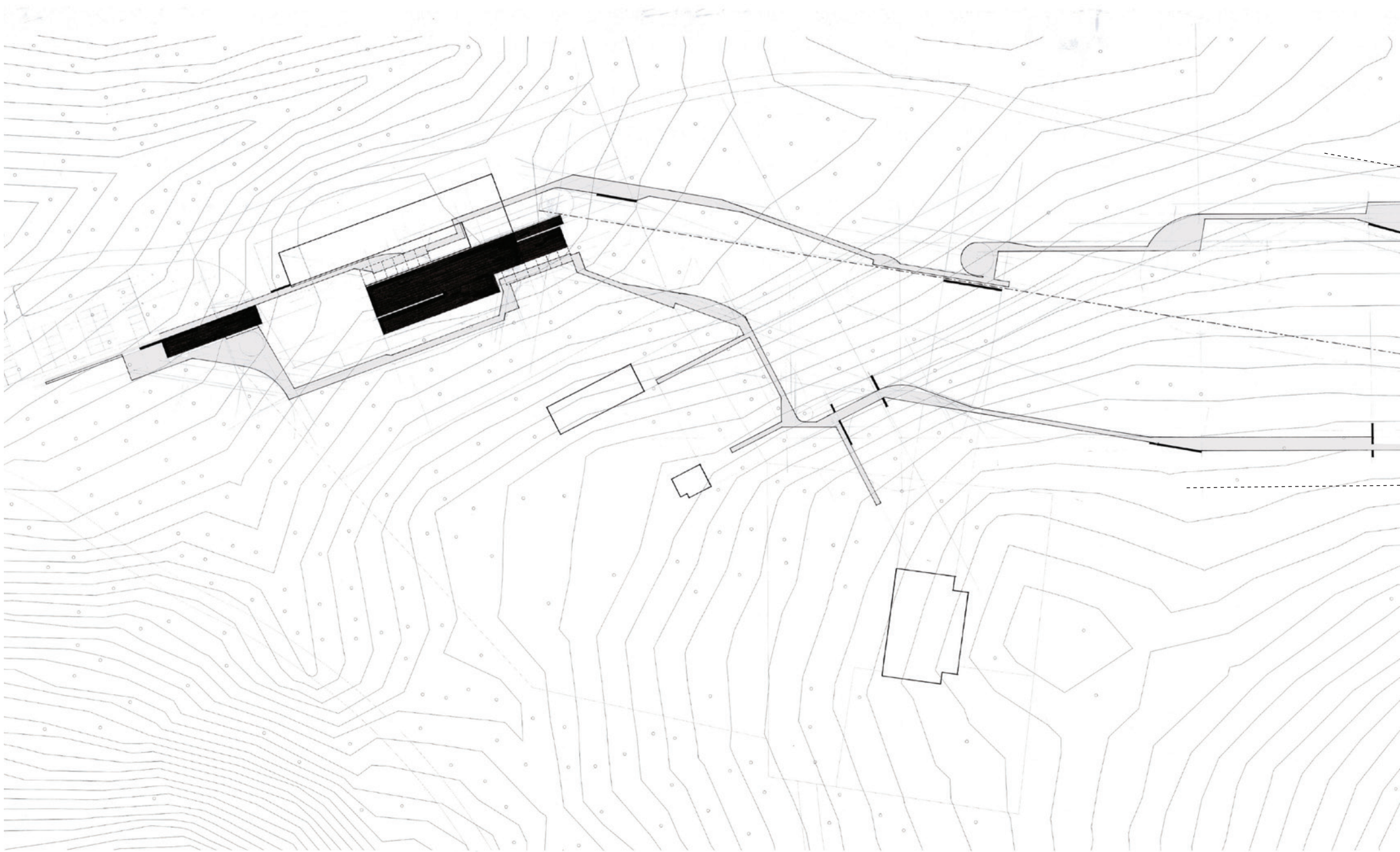


Figure 189: Massing in context for 5000 (author, 2023).



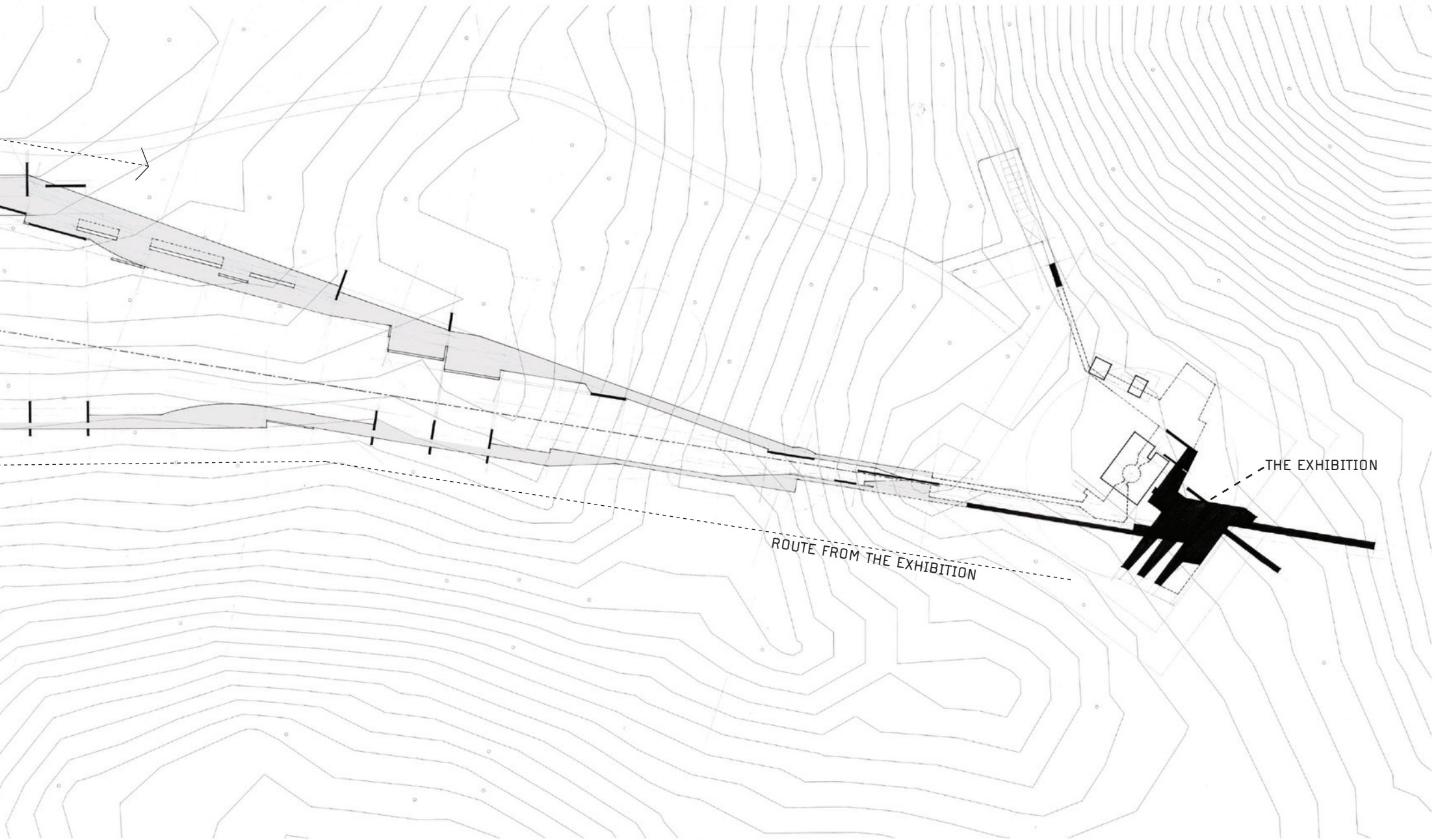


Figure 190: Preliminary site plan, focussing on the different experiences of the path to and the path from (author, 2023).

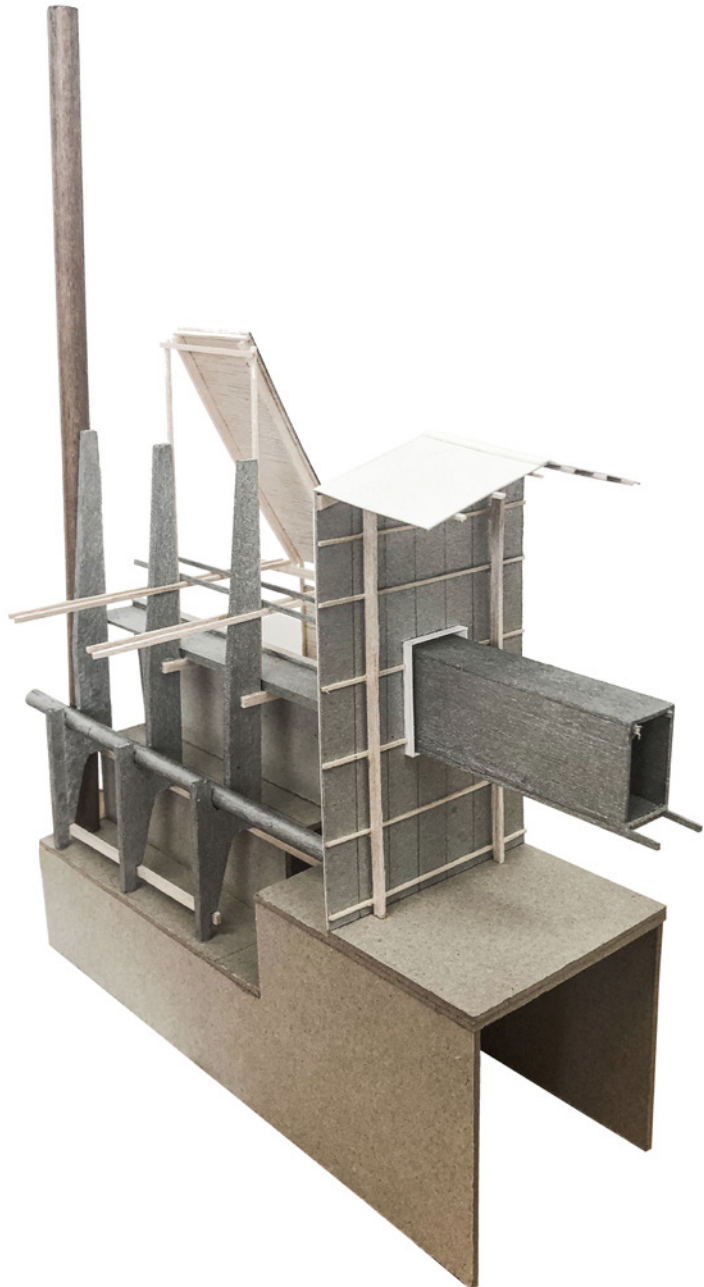


Figure 191: Tectonic model (author, 2023).

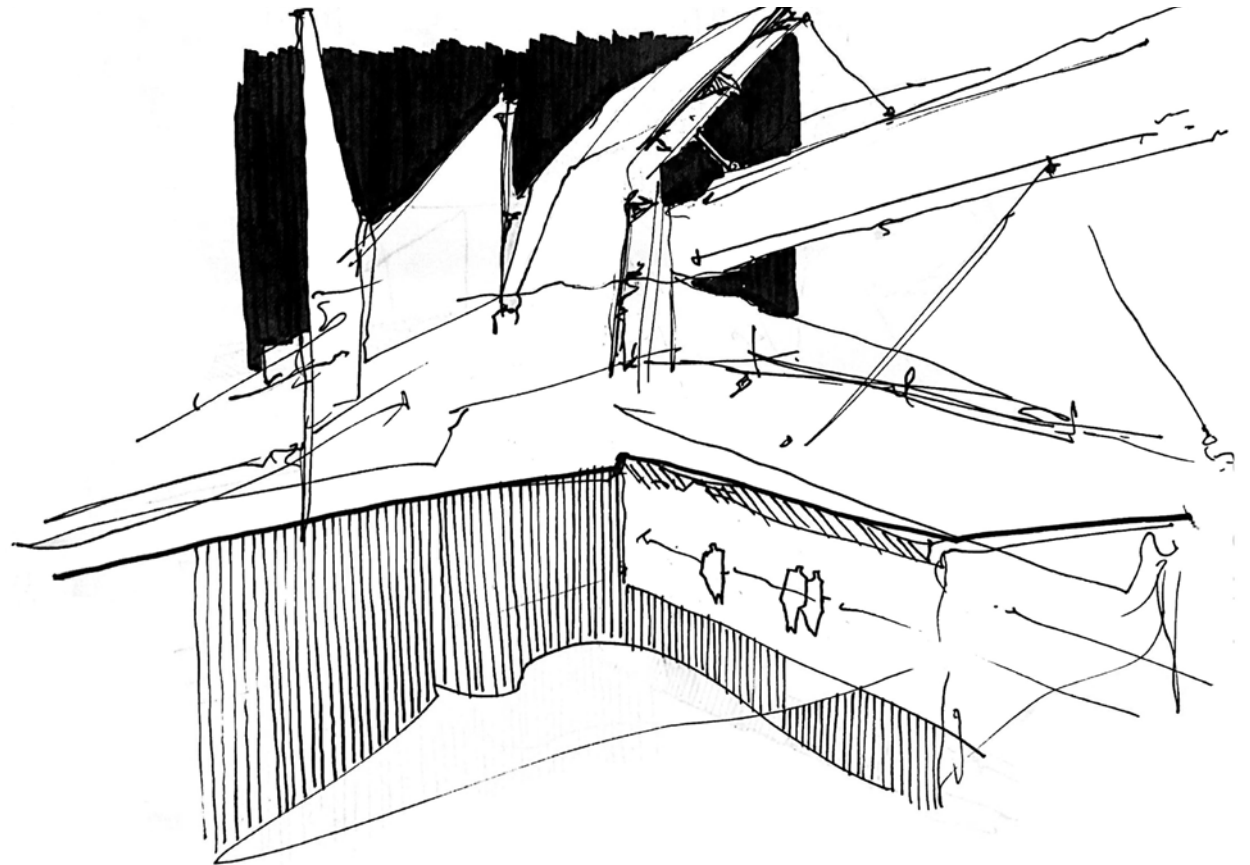


Figure 192: Nuclear morphology (author, 2023).

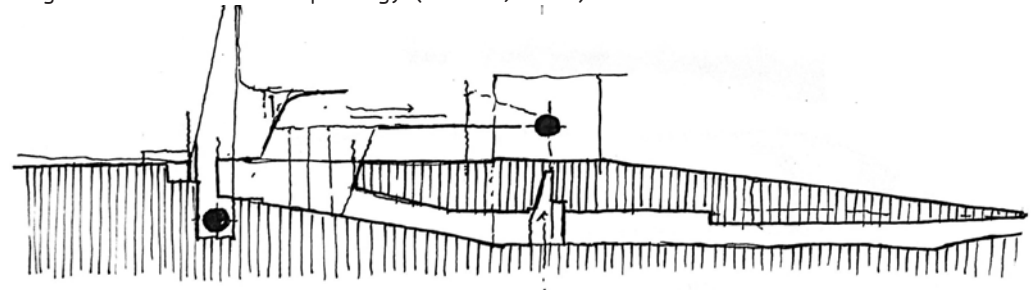


Figure 193: Massing in section for building 5000 (author, 2023).

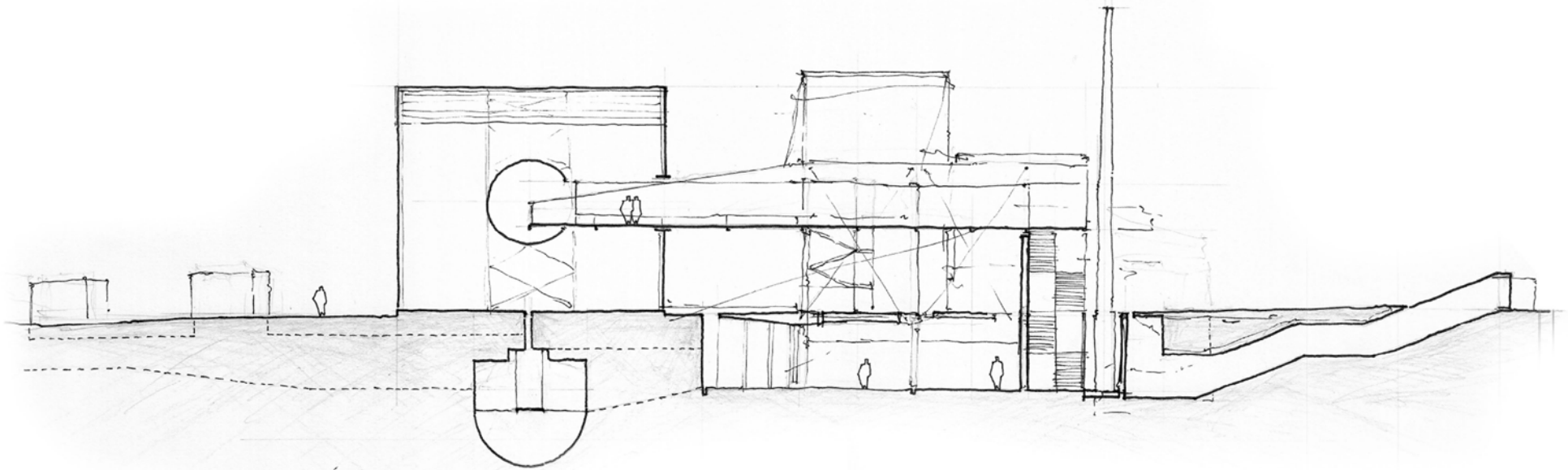


Figure 194: Building 5000 section, bridge to existing (author, 2023).

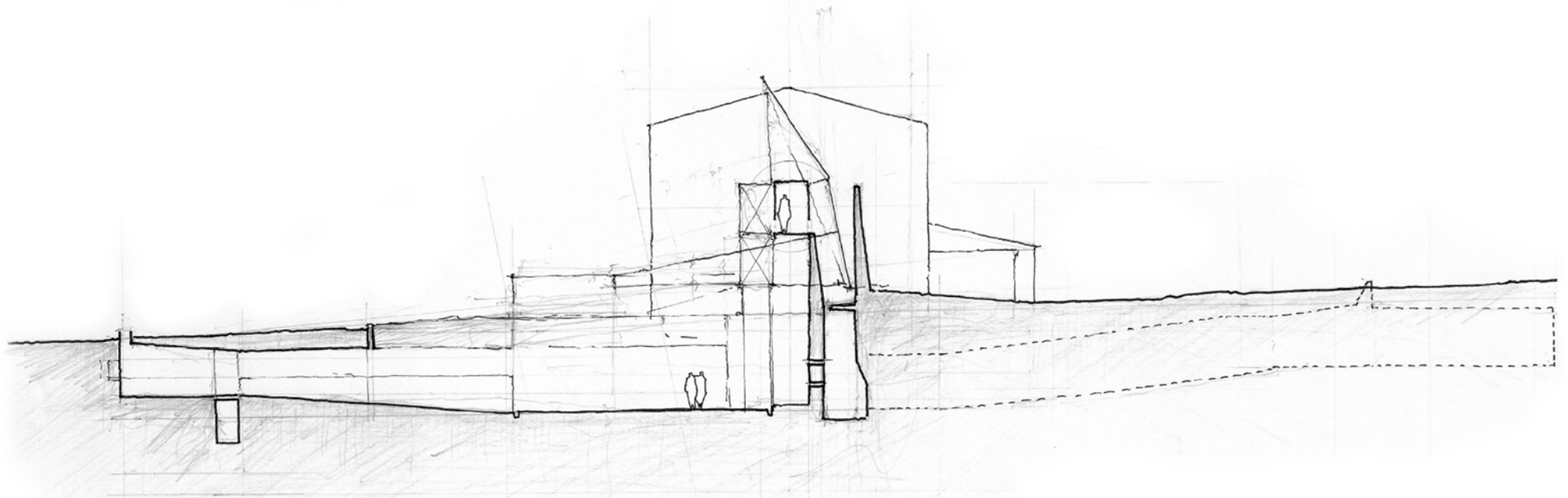


Figure 195: Section through landscape (author, 2023).



Figure 196: Abstract interpretation of the inverted monument (author, 2023).

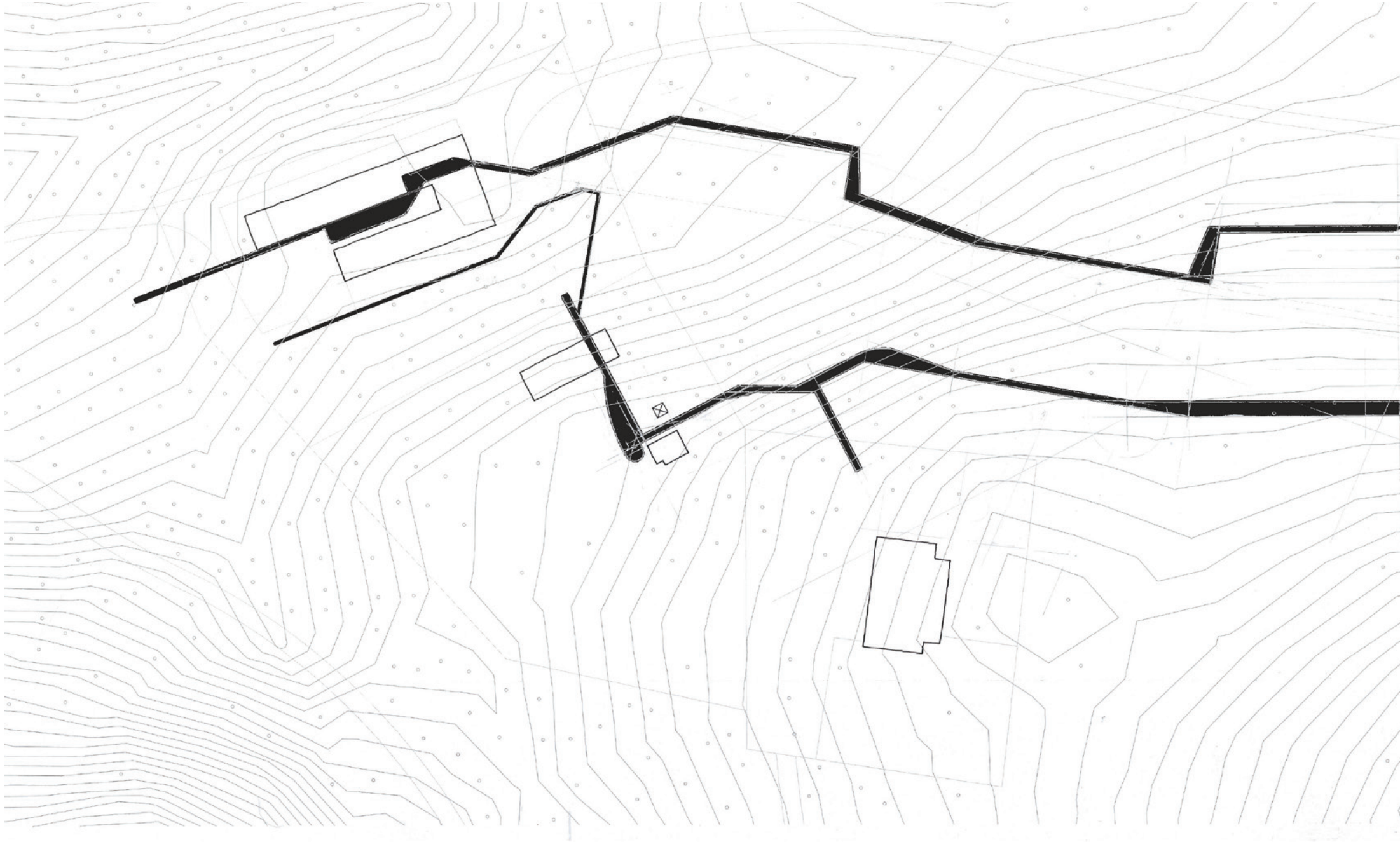


Figure 197: Triggering memory (author, 2023).



Figure 198: Populating space and creating steel form (author, 2023).

ENTRANCE



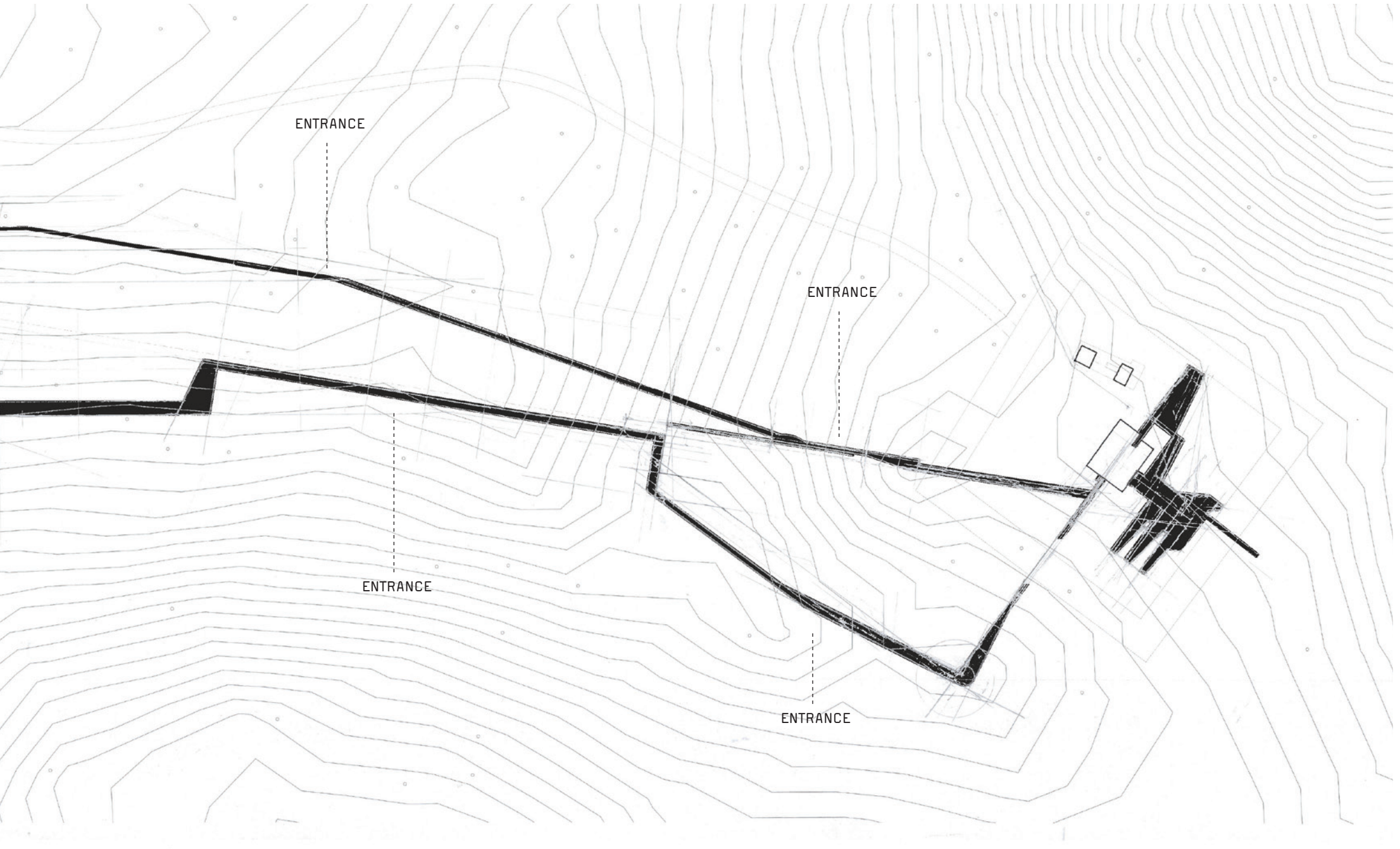


Figure 199: Preliminary site plan, developing a method to follow landscape and control line (author, 2023).

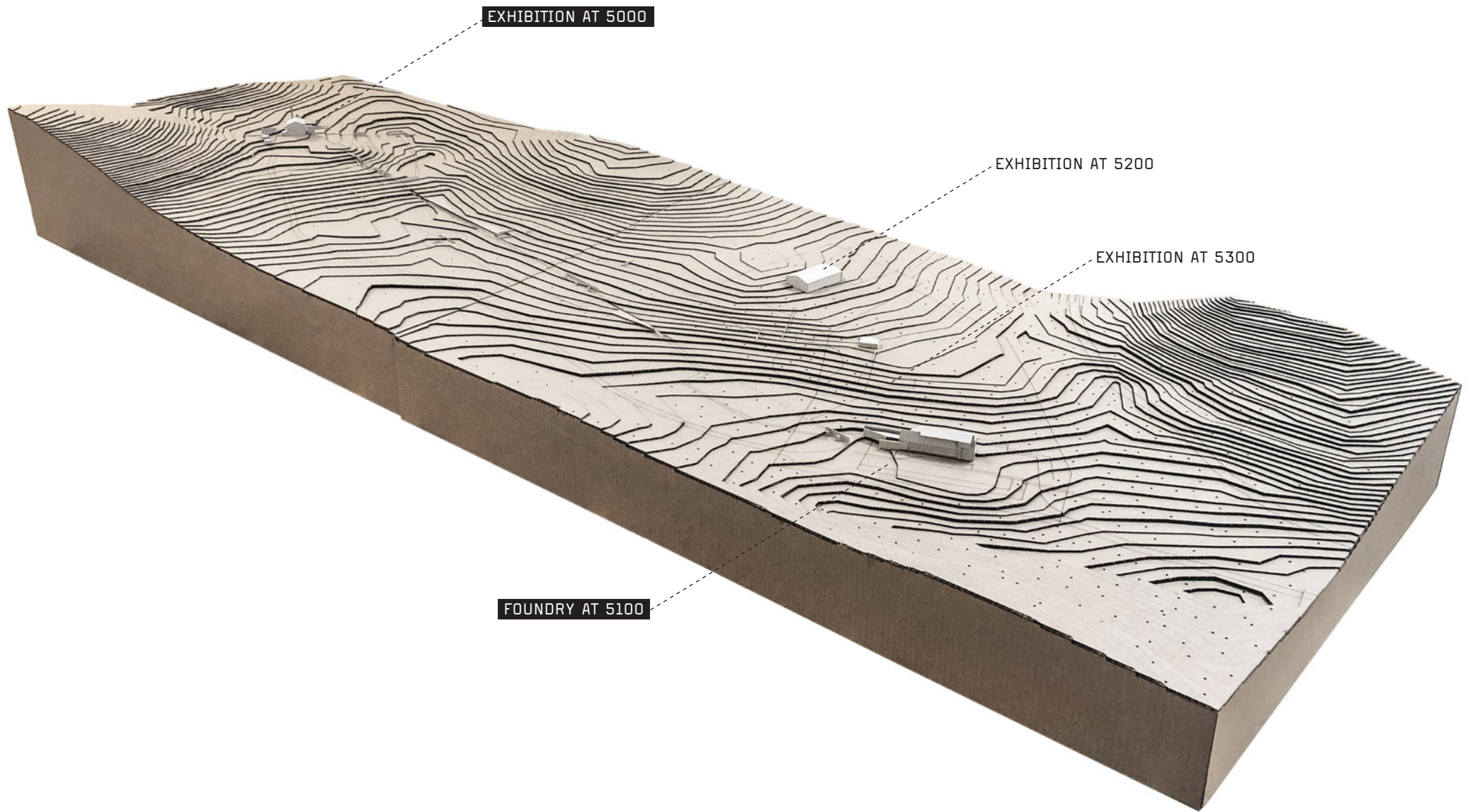


Figure 200: Large model showing site, design massing and the path on the control line (author, 2023).

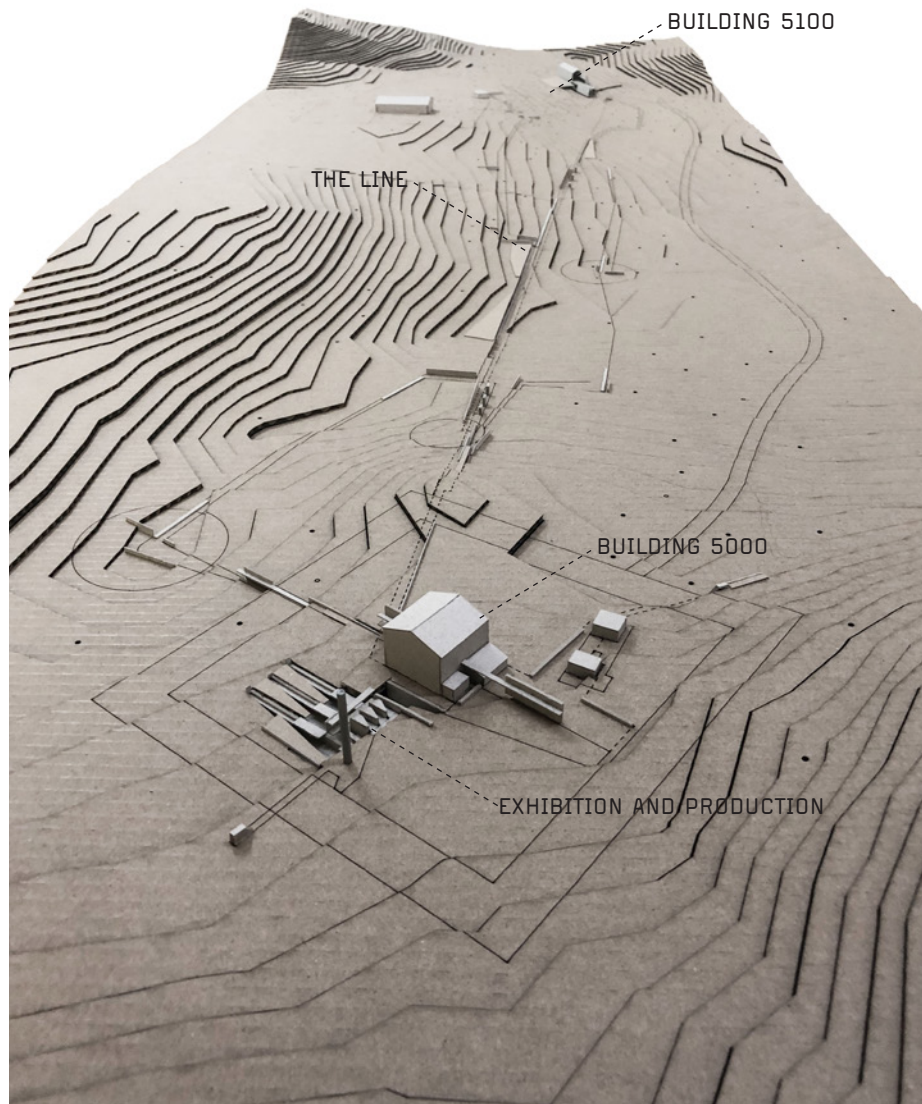


Figure 201: Building 5000 looking down the line (author, 2023).

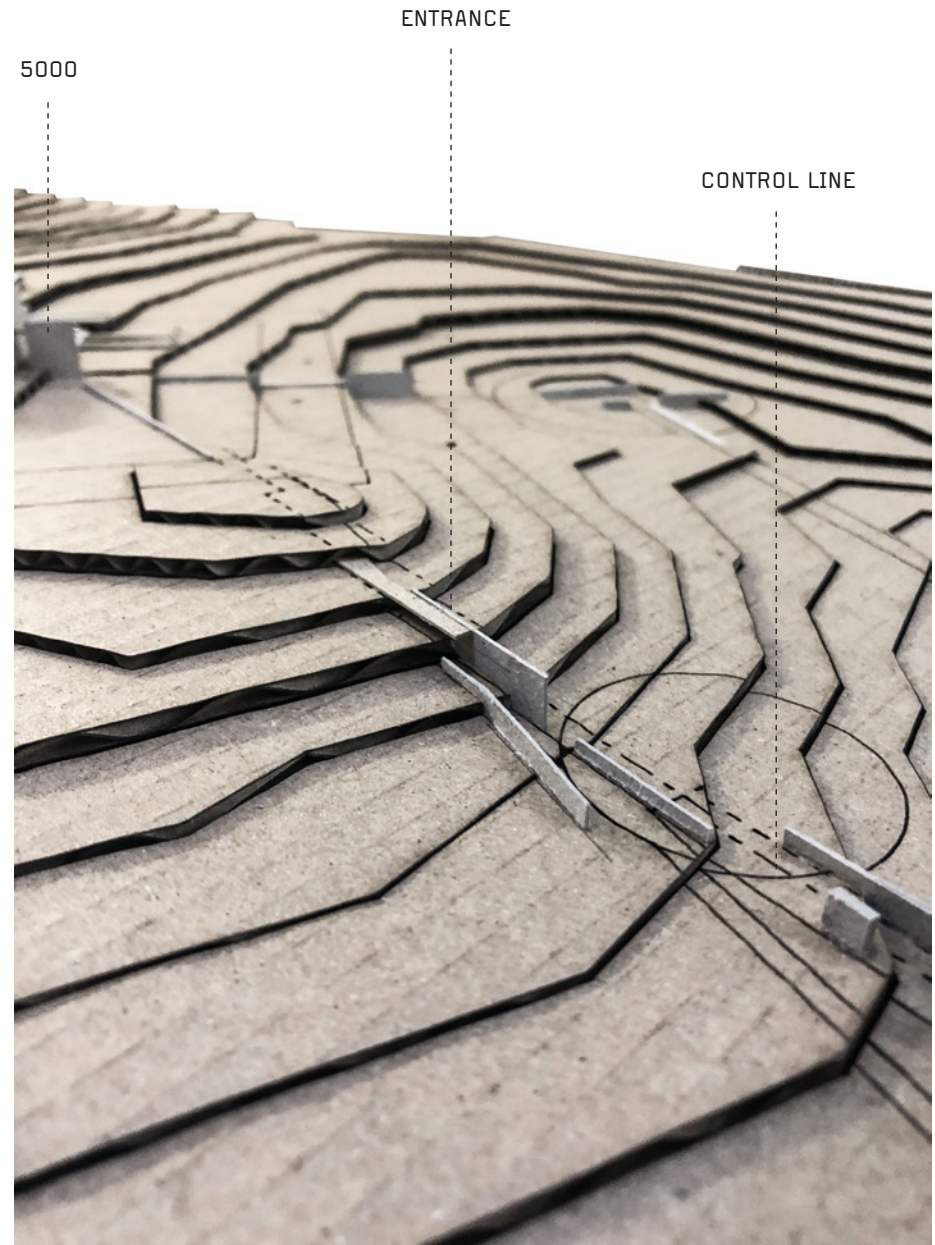
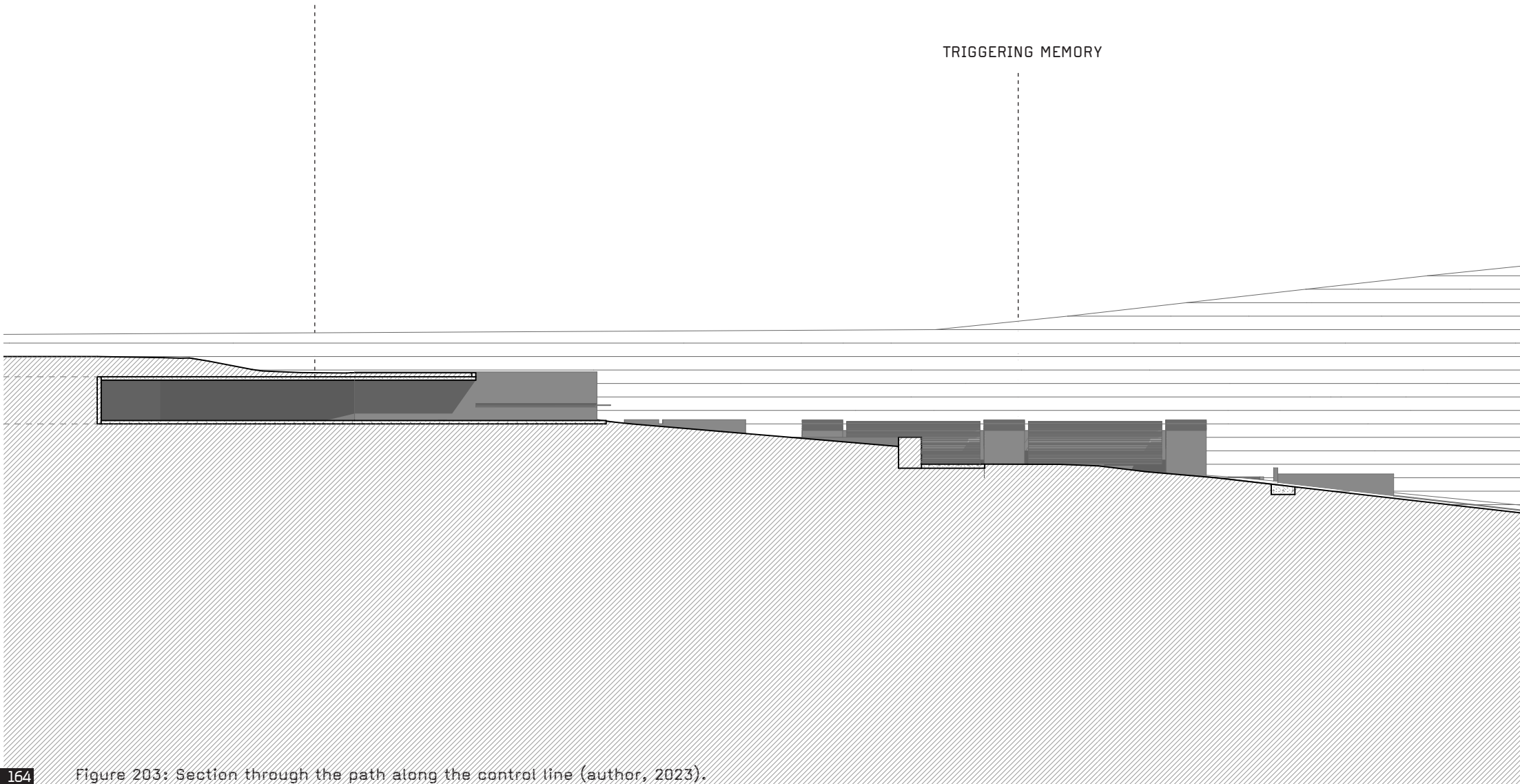


Figure 202: Moments entering the underneath (author, 2023).

Some establishments on the route along the control line:

UNDERNEATH

TRIGGERING MEMORY



FOLLOWING LANDSCAPE
(UNSEEN)

SCAR (TRENCH)

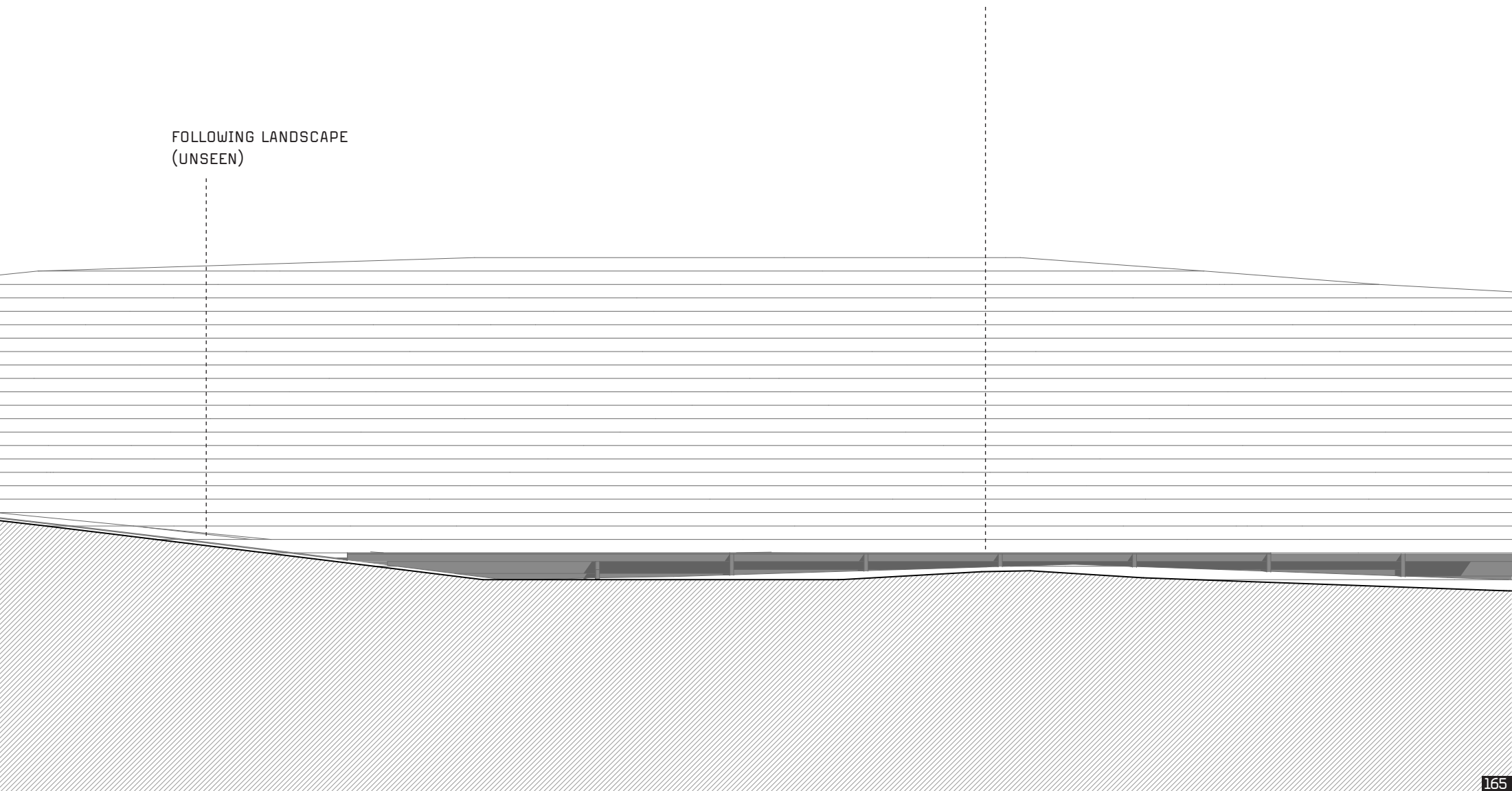




Figure 204: Following the landscape (author, 2023).

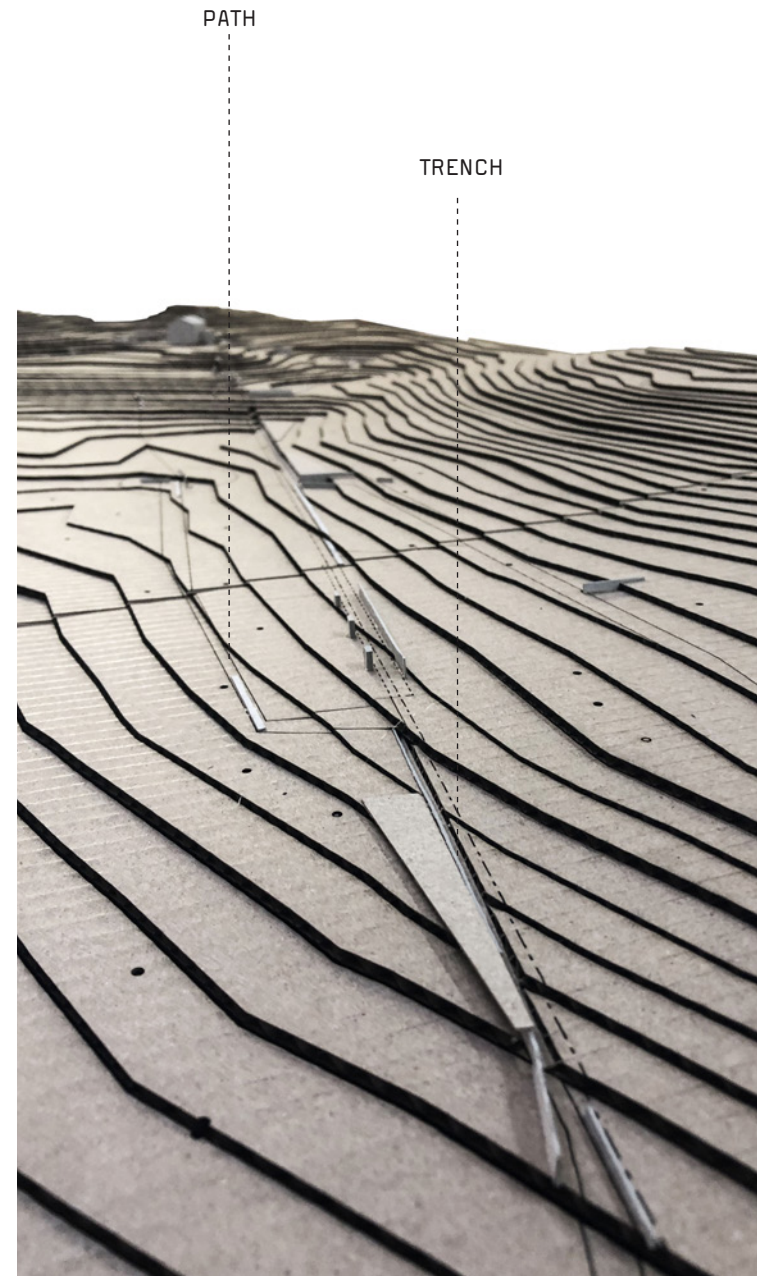


Figure 205: Adhering vs deviating (author, 2023).

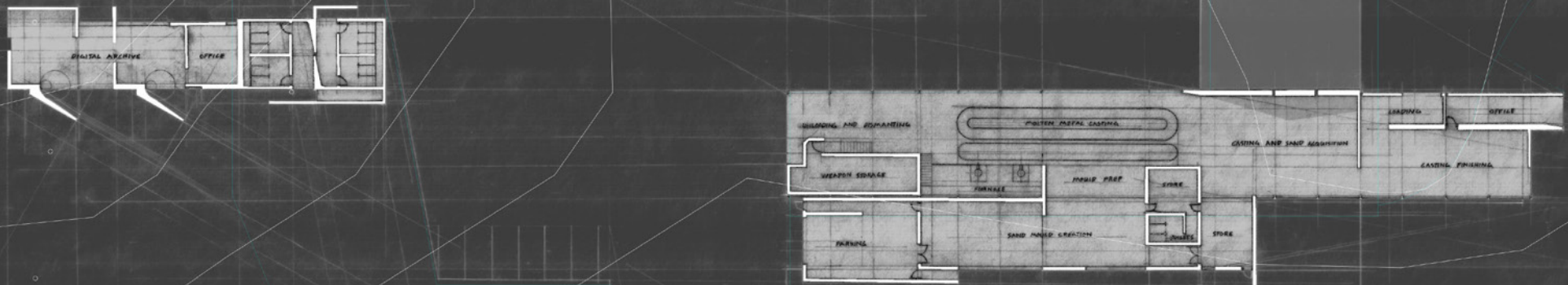


Figure 206: March (author, 2023).



Figure 207: Entering the underneath on the line (author, 2023).

5100



WOOD	TITLE	BUILDING	DATE	SCALE
	SHEET		DATE	
	CONTRACT	WOOD/1000	CHECKED	DATE
	PROJECT		DATE	
	REV.		DATE	

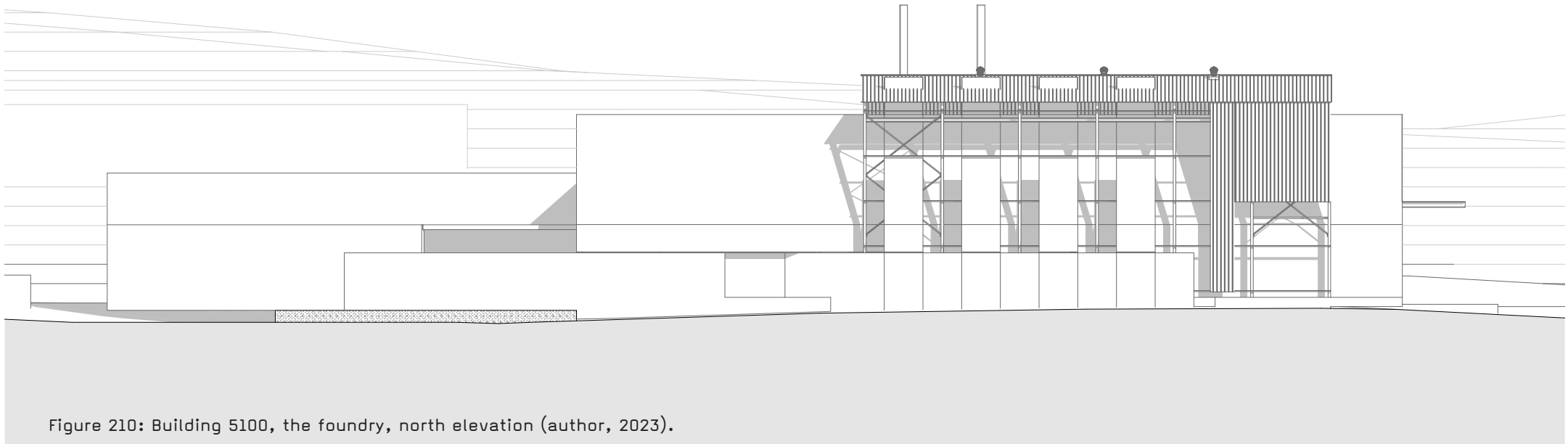


Figure 210: Building 5100, the foundry, north elevation (author, 2023).

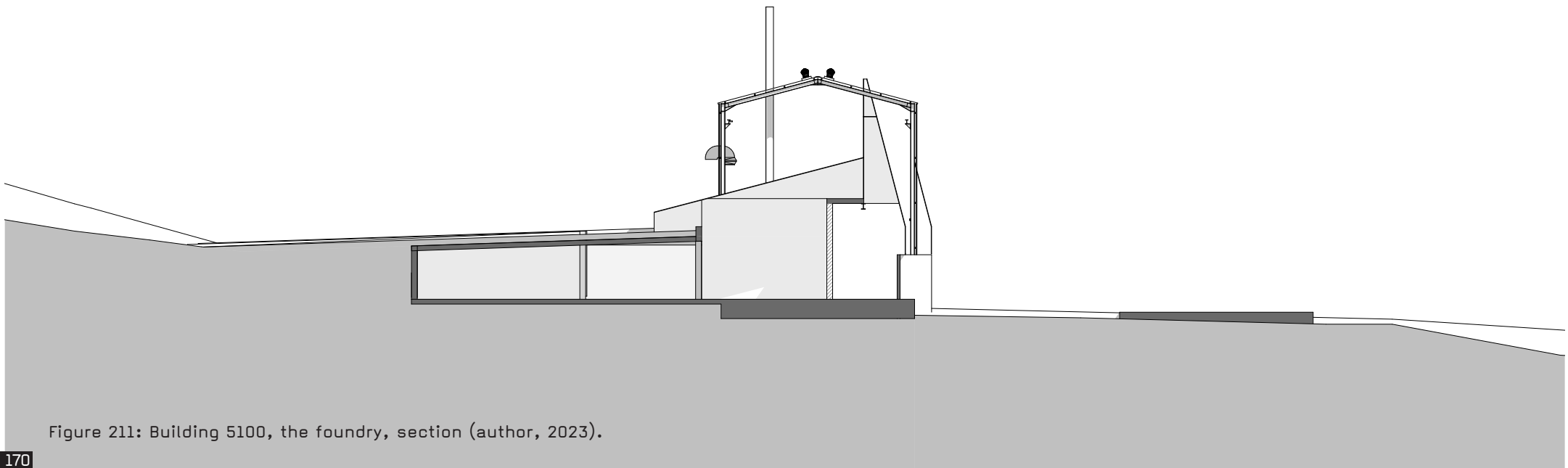


Figure 211: Building 5100, the foundry, section (author, 2023).

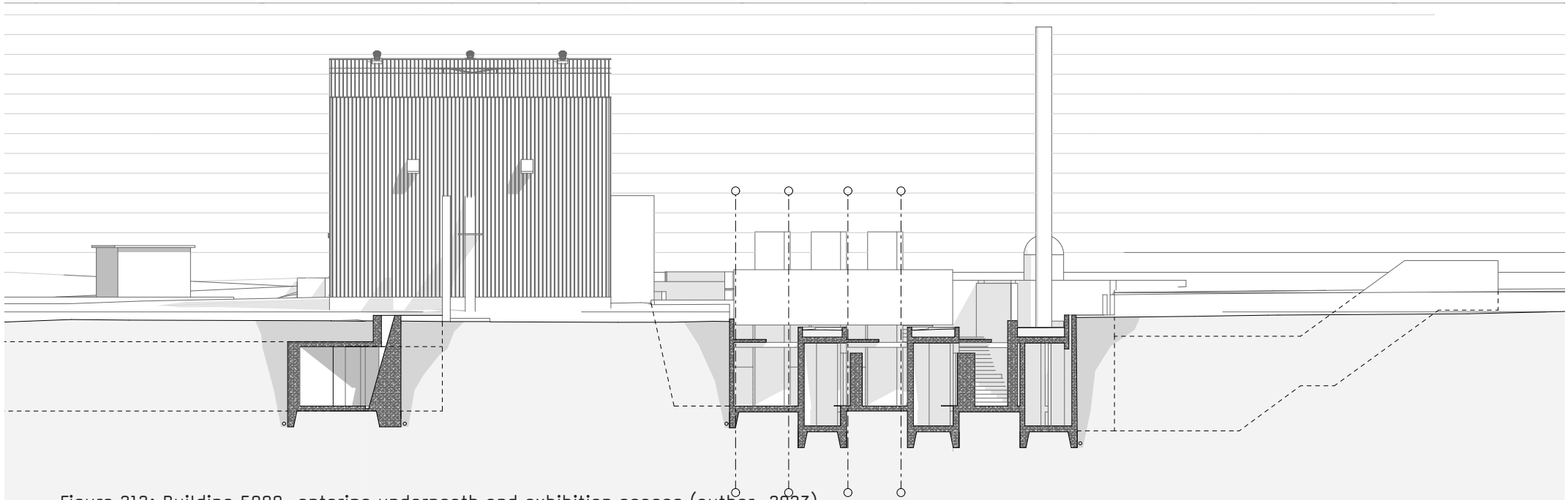


Figure 212: Building 5000, entering underneath and exhibition spaces (author, 2023).

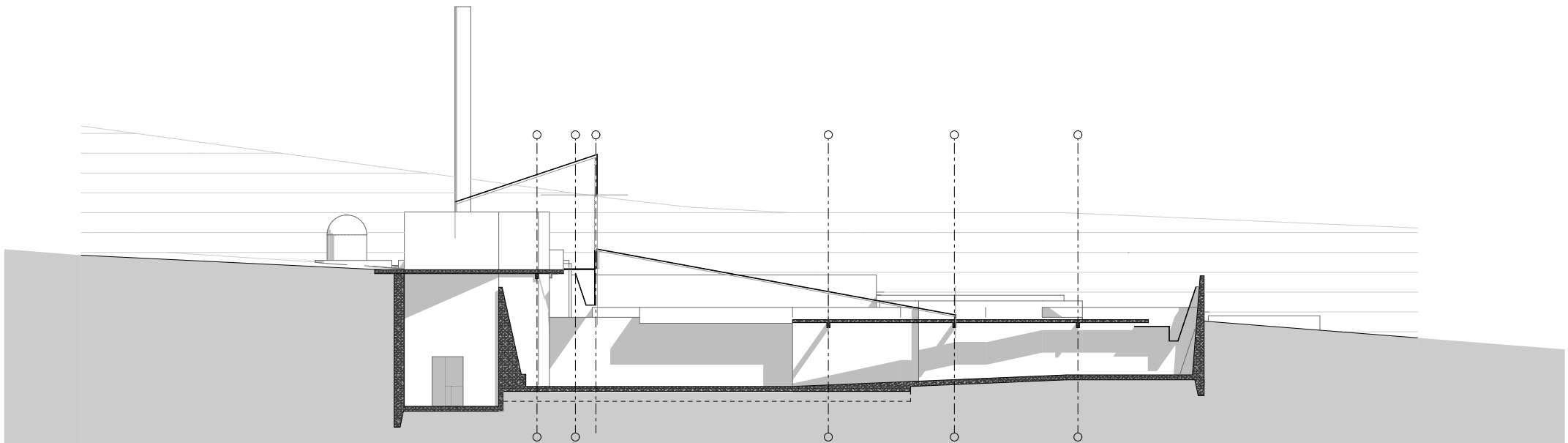


Figure 213: Building 5000, digging into the landscape (author, 2023).



Figure 214: The foundry preliminary perspective (author, 2023).



Figure 215: The foundry preliminary perspective (author, 2023).



Figure 216: The foundry rough massing (author, 2023).

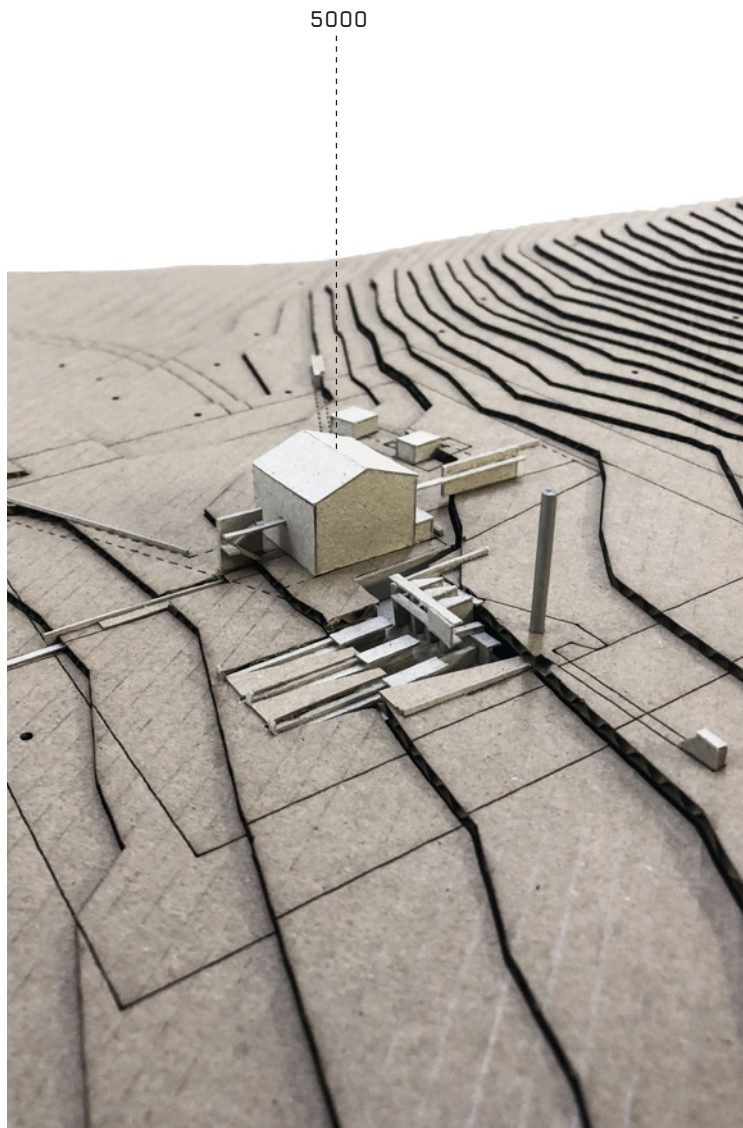


Figure 217: The exhibition rough massing (author, 2023).

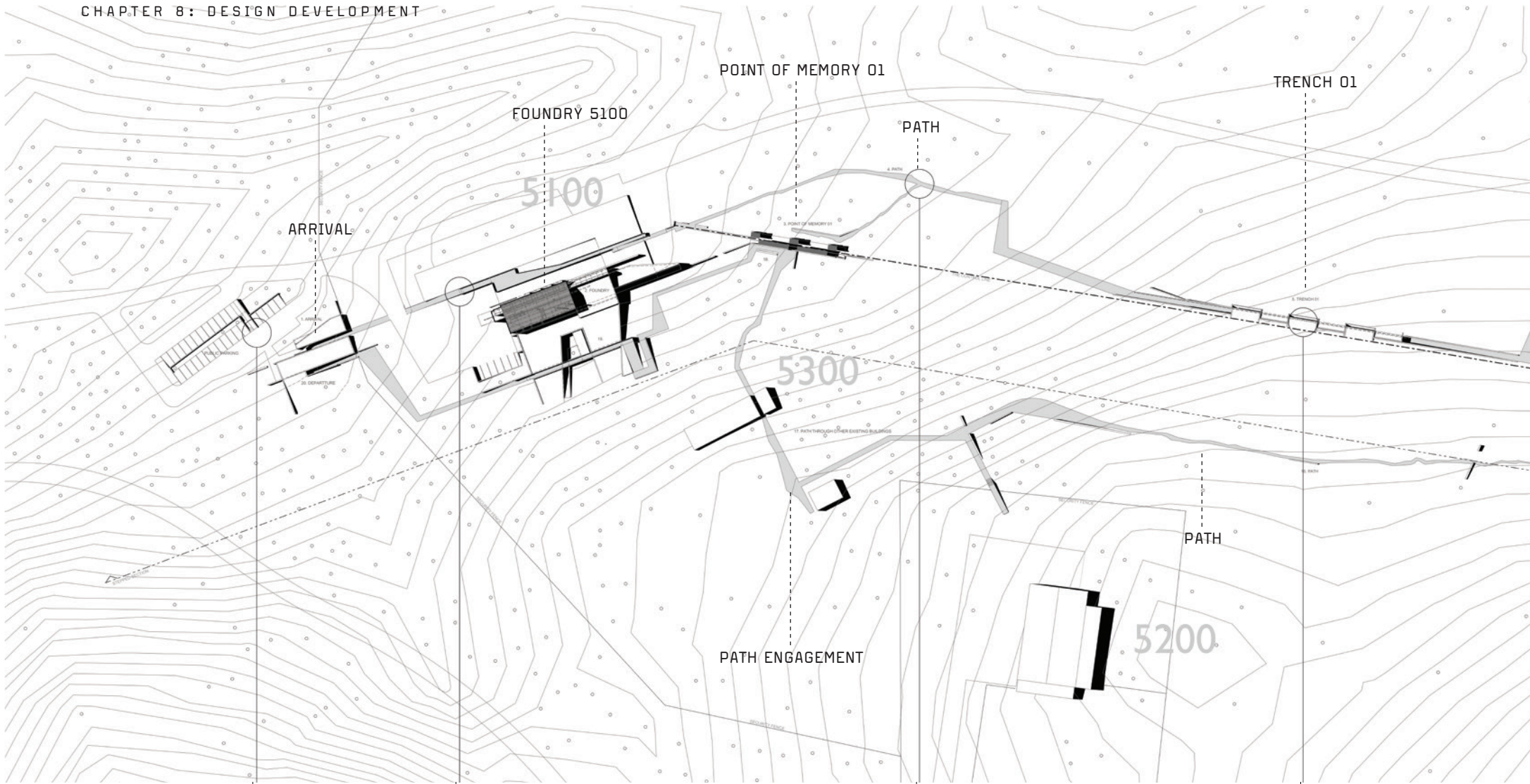


Figure 218: Preliminary perspective of structure breaking out of ground (author, 2023).

8.3 TOWARDS FINAL DESIGN

Towards final design means that the following work is the final design for this document but not the final intended design for this thesis. It lays a foundation for the reader to understand what the design is without fully revealing the whole of the scheme. This plays into the core of this thesis. Just as not all is disclosed to the visitor of the site, the reader must now embark on a journey through the design, gaining glimpses into the project and use the clues throughout this document to recall understanding of the program.

Please turn to the end of the design chapter, page 209, and unfold the map diagram to correlate the graphics on the following pages to their location on the site and then continue through the chapter as normal with the map remaining unfolded. The order of the graphics follows the same narrative of the route that visitors would take from the arrival before the foundry, up the hill to the exhibition and back again on a separate route past the foundry and departing. The only difference here being that the chapter concludes here with Building 5000, the exhibition and undisclosed production facility, as it is the focus of the architectural design of this thesis.



1. ARRIVAL



2. FOUNDRY

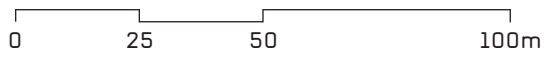


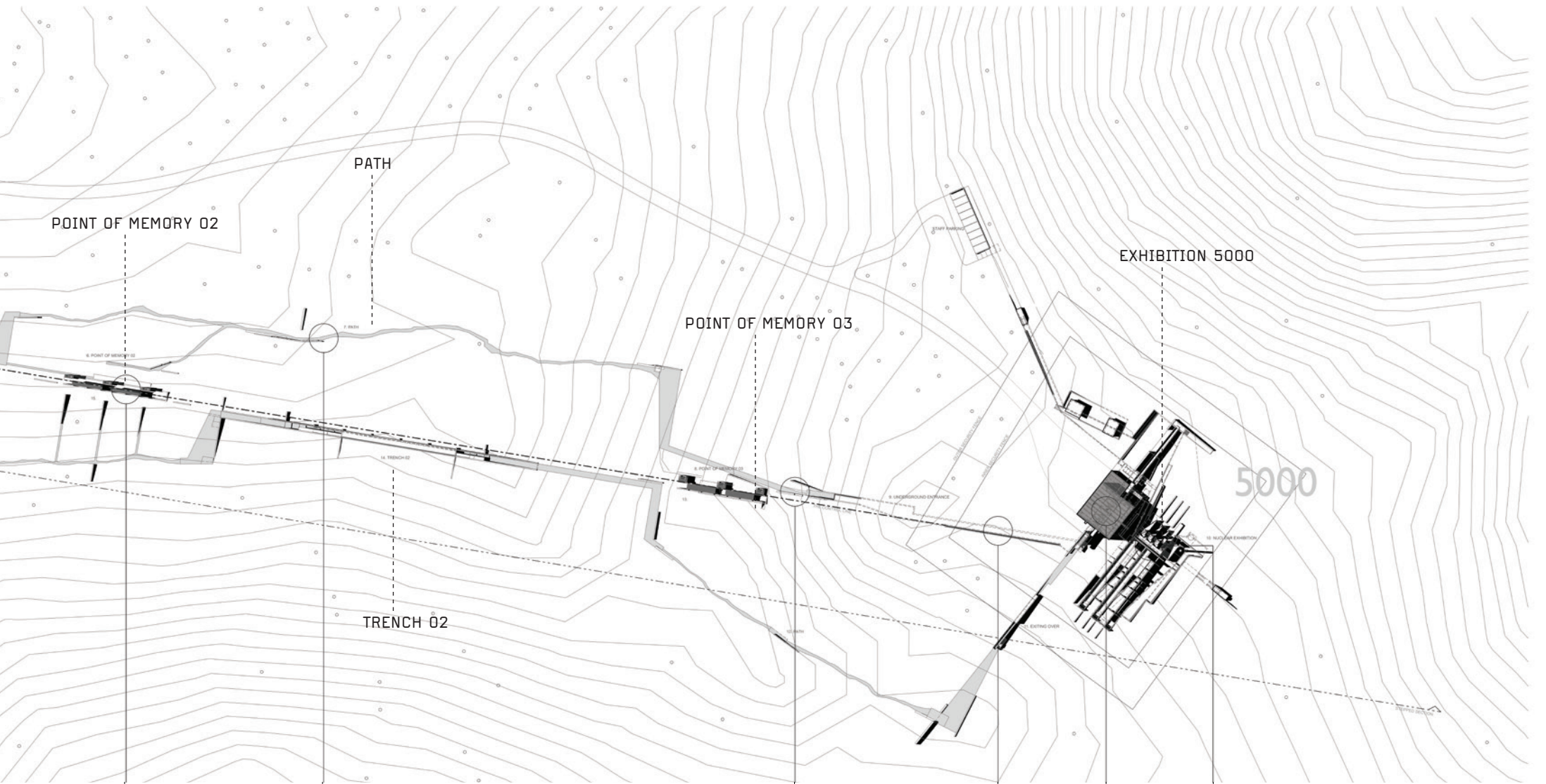
3. PATH



4. TRENCH 01

SITE PLAN





5. POINT OF MEMORY 02



6. PATH



7. ENTRANCE



8. UNDERGROUND ENTRANCE



9. UNDER 5000



10. THE CONCEALMENT

2. FOUNDRY 5100



FOUNDRY
THROUGH THE TREES

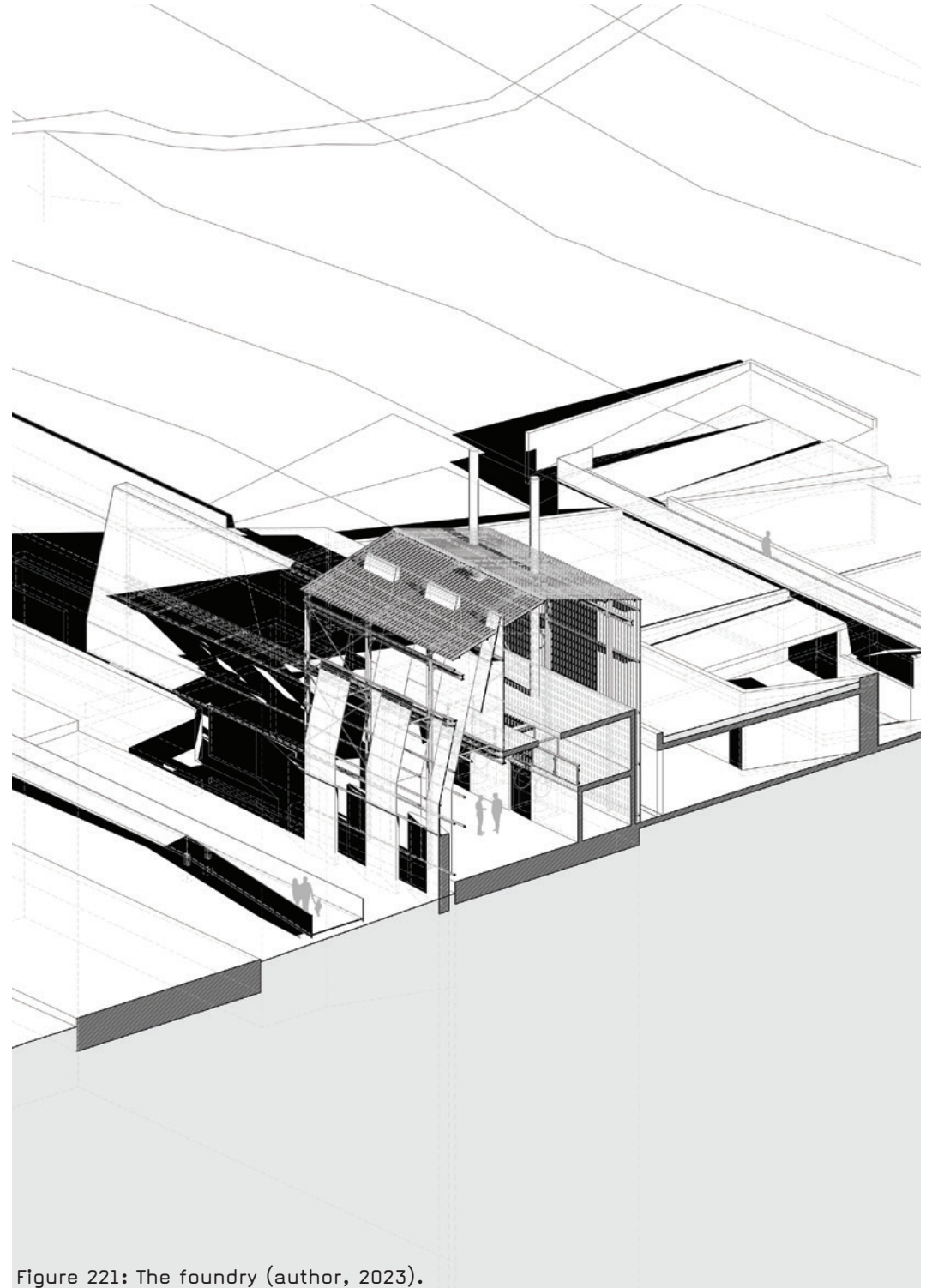


Figure 221: The foundry (author, 2023).

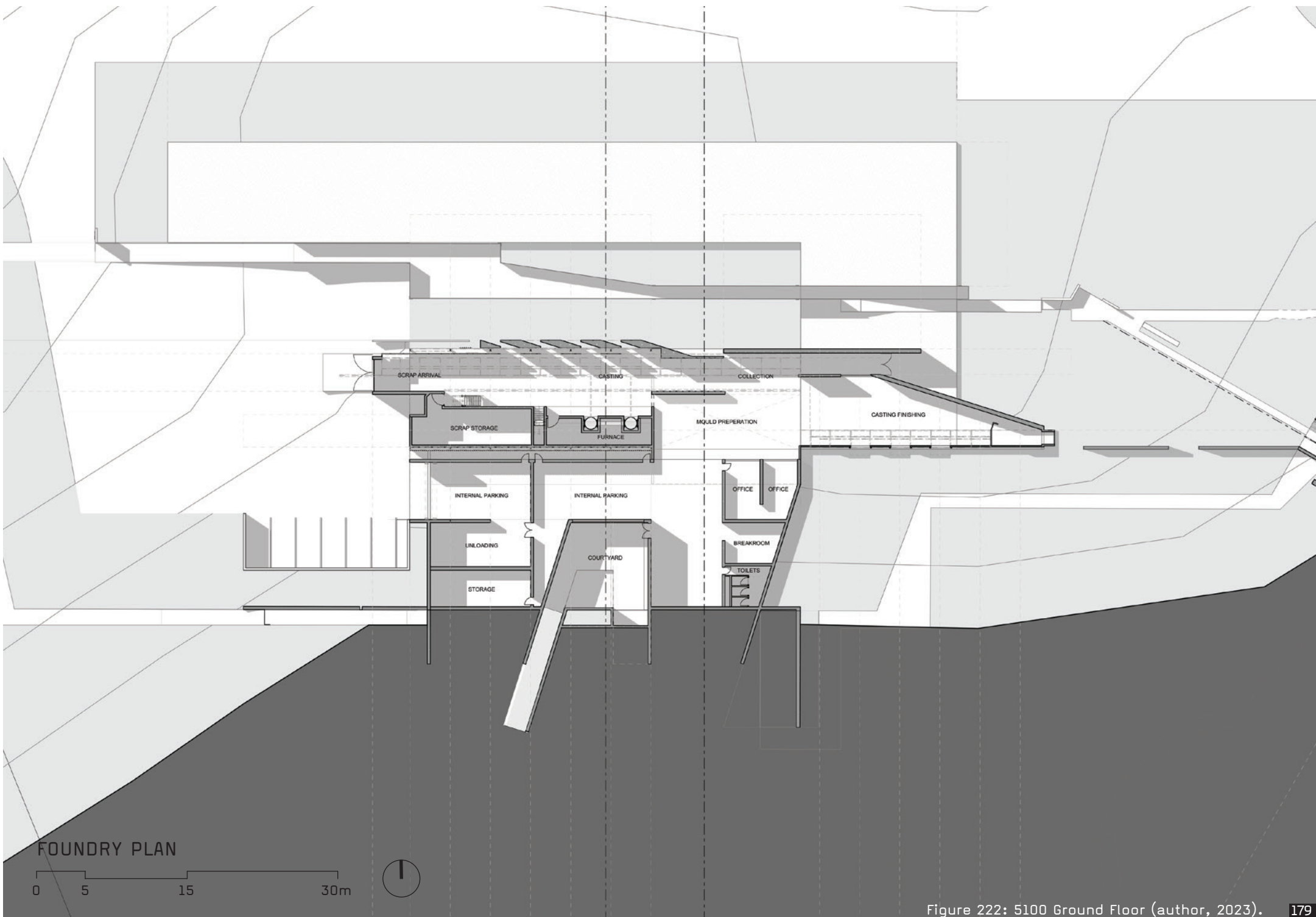


Figure 222: 5100 Ground Floor (author, 2023).

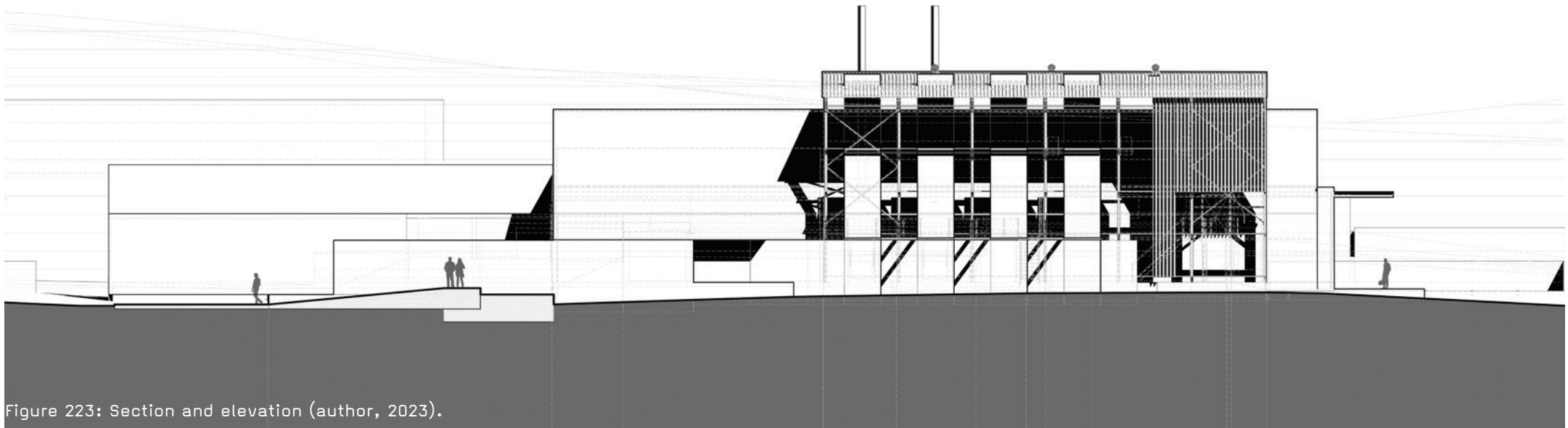
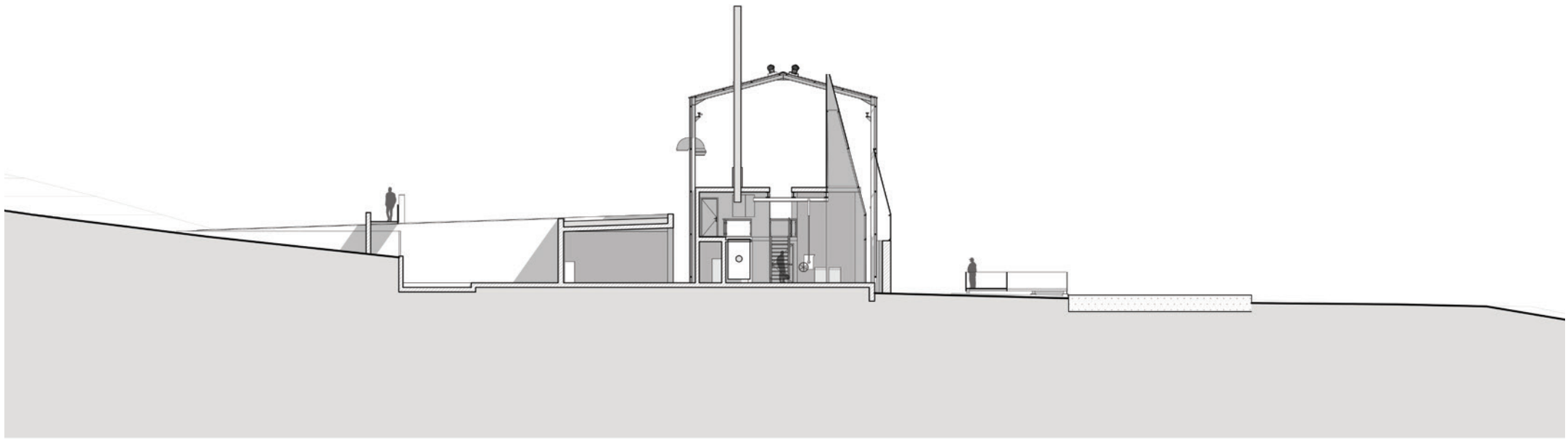
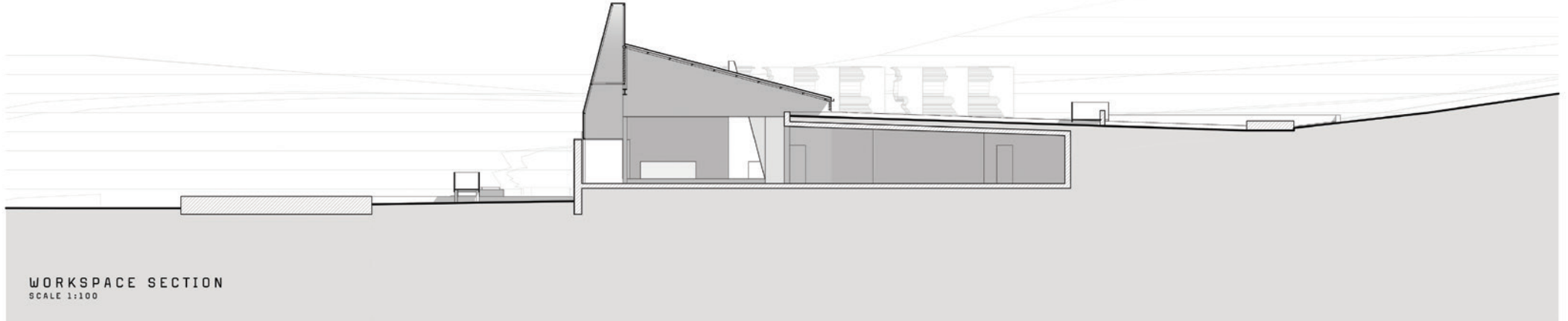


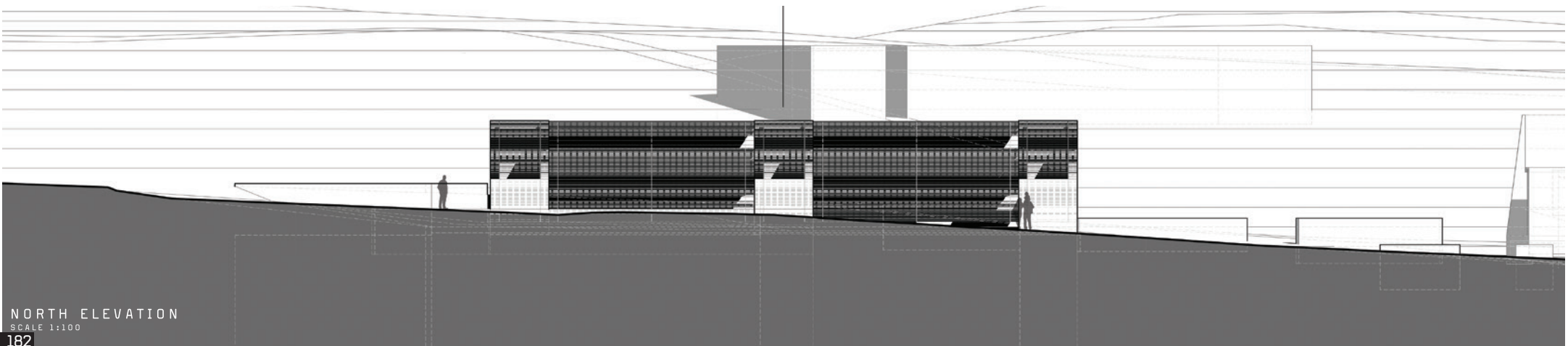
Figure 223: Section and elevation (author, 2023).



3. POINT OF MEMORY 01



Figure 226: Unknown forms (author, 2023).



NORTH ELEVATION
SCALE 1:100



Figure 227: The Cuito Cuanavale memorial (Silva, 2022).

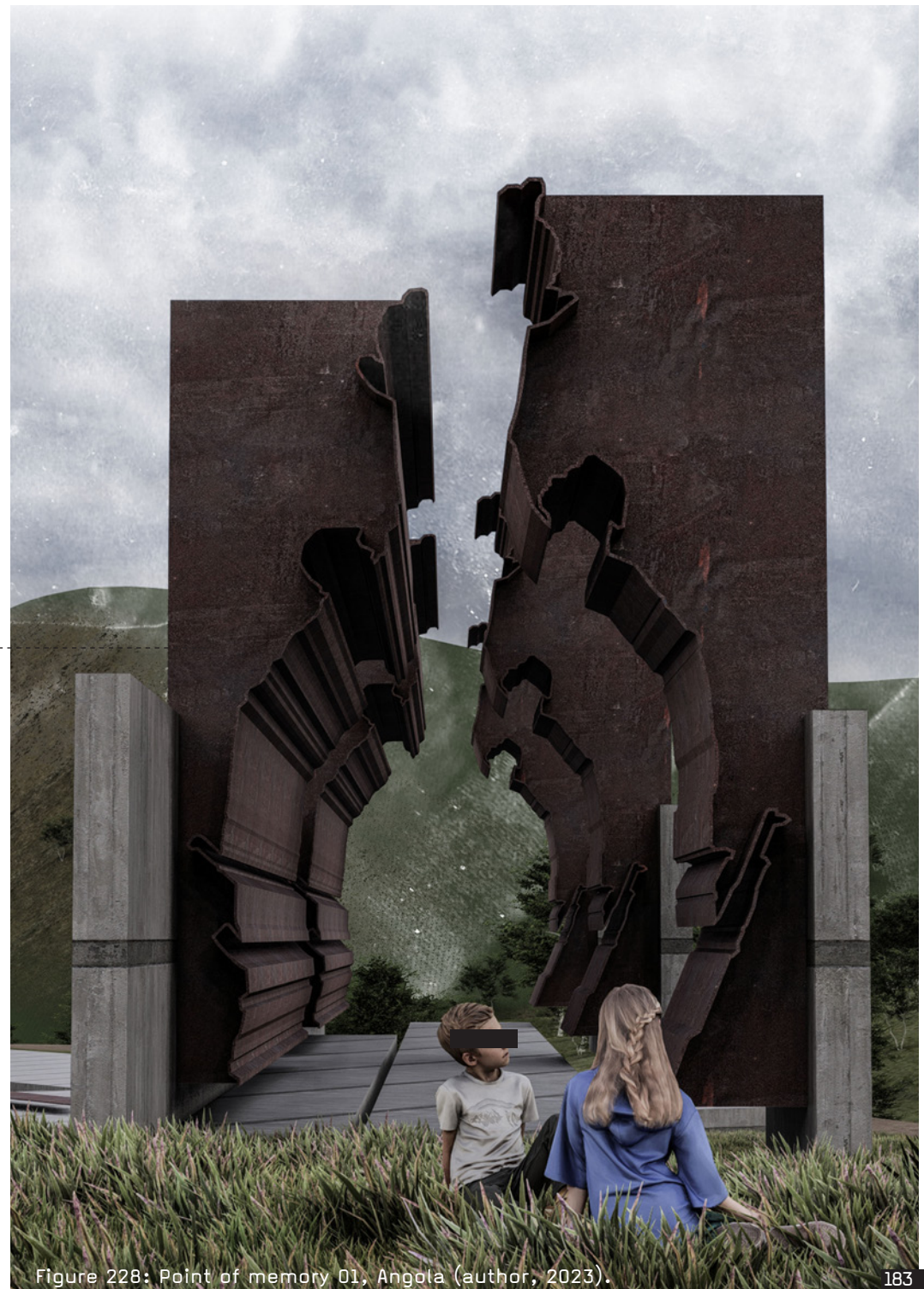
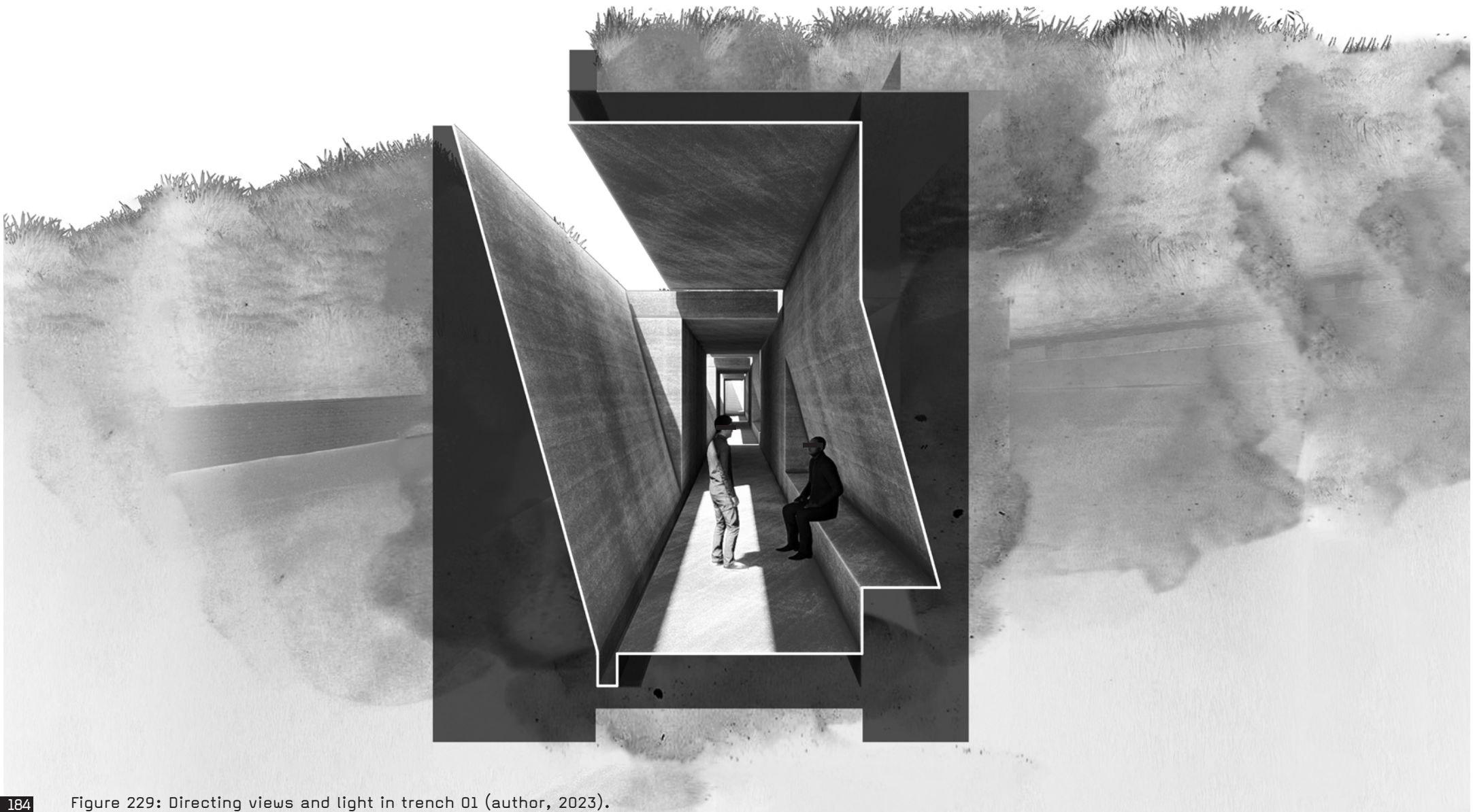


Figure 228: Point of memory 01, Angola (author, 2023).

5.TRENCH 01



184 Figure 229: Directing views and light in trench 01 (author, 2023).

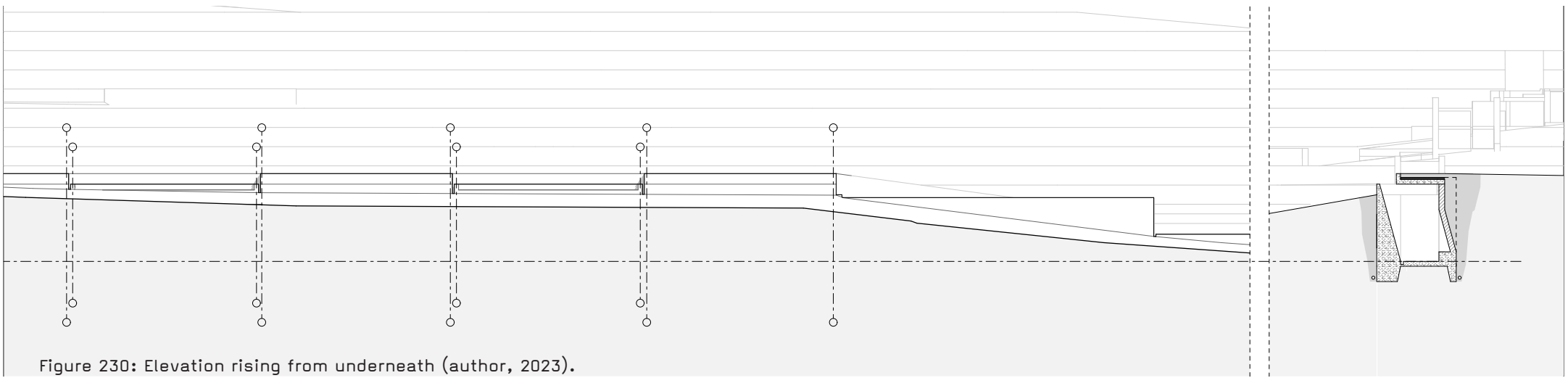


Figure 230: Elevation rising from underneath (author, 2023).

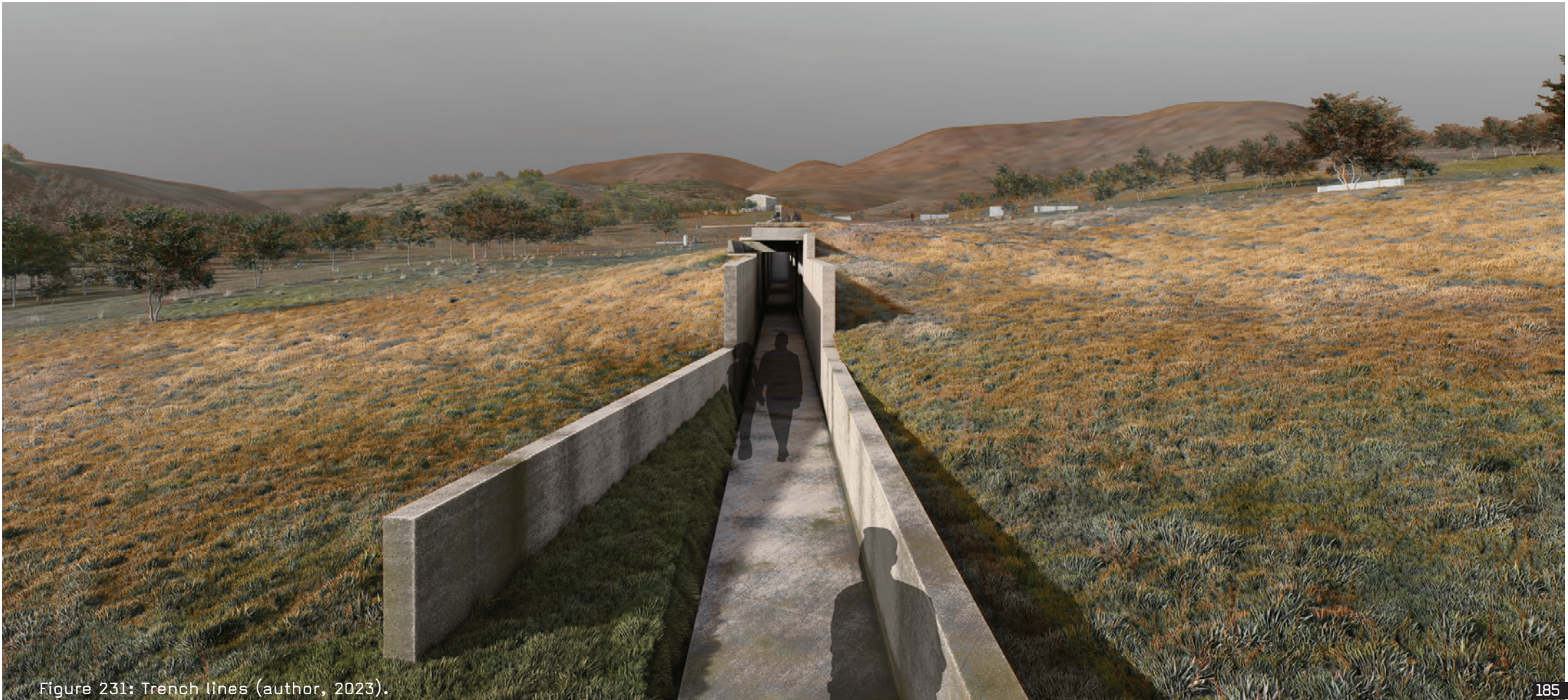


Figure 231: Trench lines (author, 2023).

6. POINT OF MEMORY 02





Figure 233: The Eenhana Shrine (Baines, 2014).



Figure 234: Point of memory 02, Namibia (author, 2023).

7. PATH — ON THE ROUTE TO



PATH (FOLLOW) -----

TRENCH 02 (SCAR) -----





Figure 236: Scarring vs following (author, 2023).

14. TRENCH 02 — ON THE ROUTE FROM



Figure 237: Directing views and light in trench 02 (author, 2023).

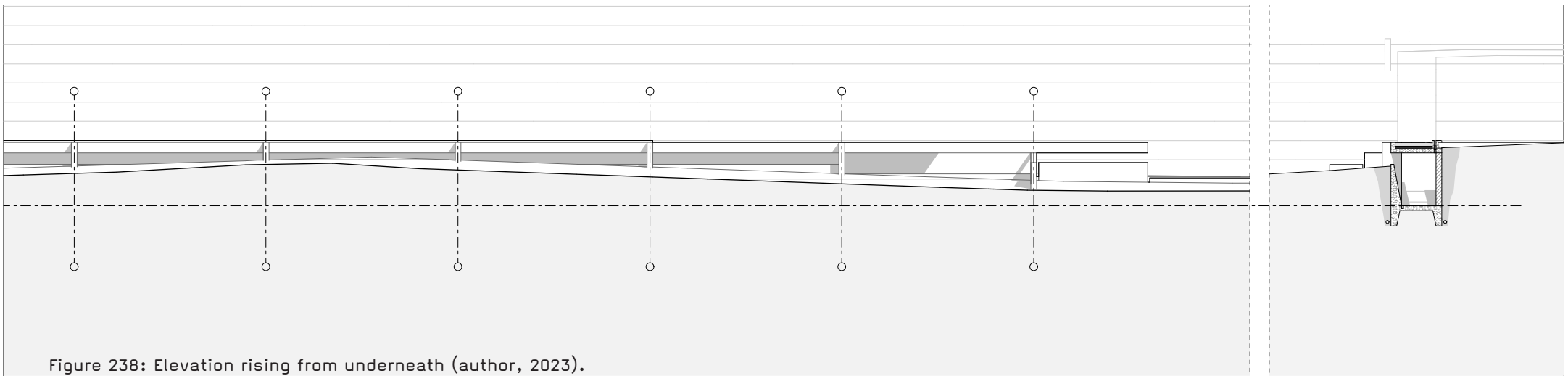


Figure 238: Elevation rising from underneath (author, 2023).



Figure 239: Trench lines (author, 2023).

8. POINT OF MEMORY 03

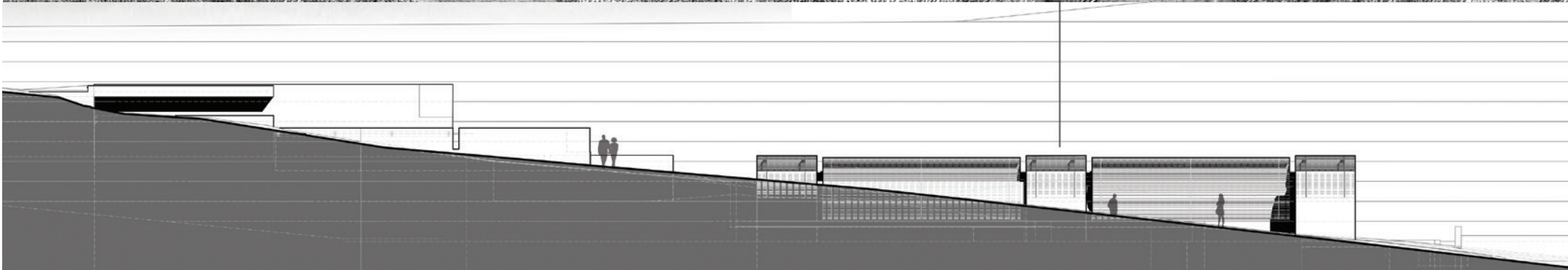


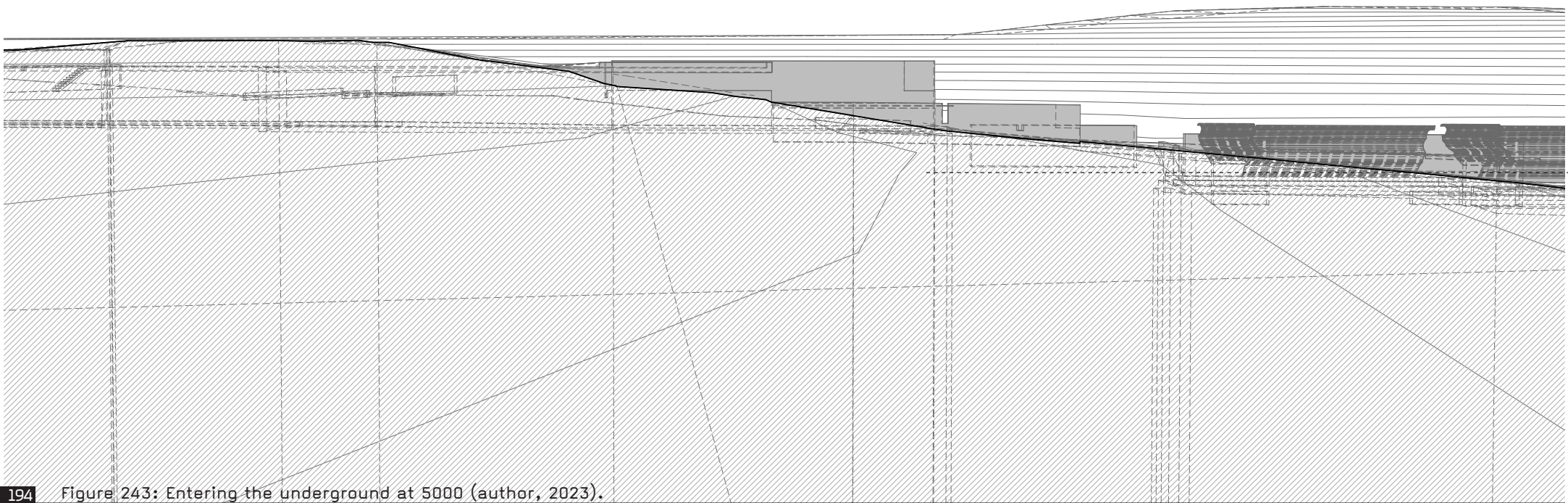


Figure 241: Fort Klapperklop (Baines, 2014).



Figure 242: Point of memory 03, South Africa (author, 2023).

9. ENTERING UNDERNEATH



194 Figure 243: Entering the underground at 5000 (author, 2023).

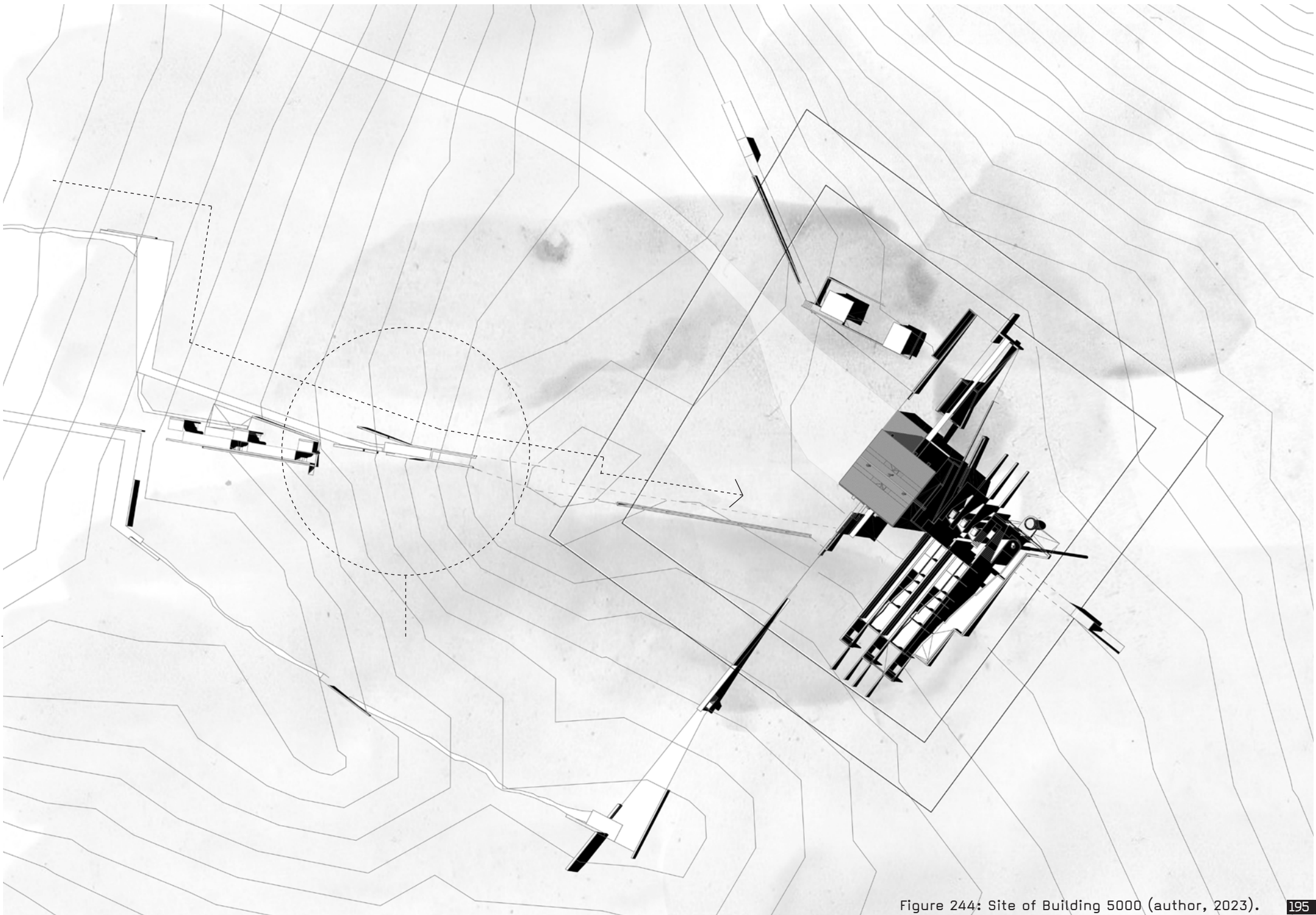
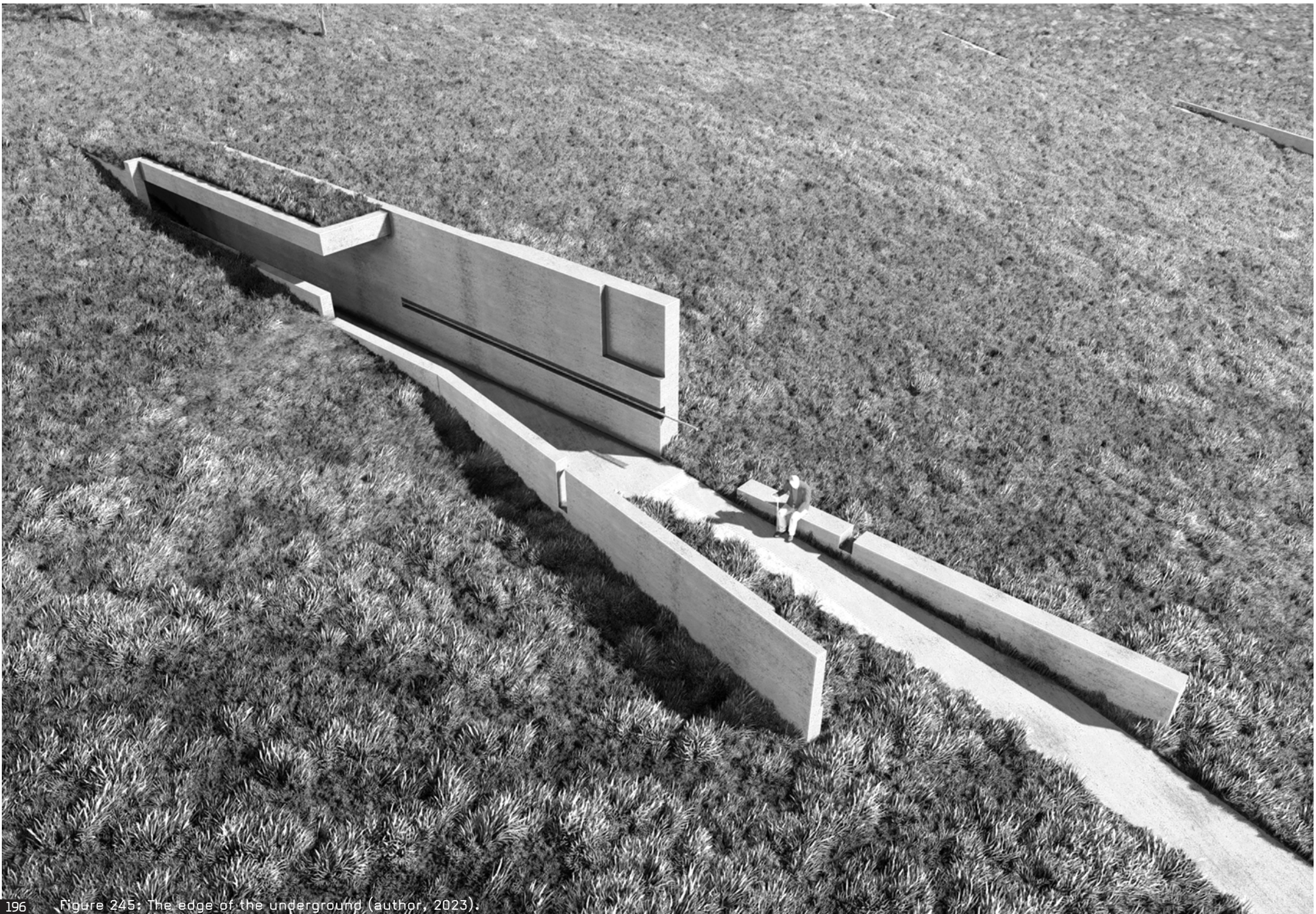


Figure 244: Site of Building 5000 (author, 2023).



196 Figure 245: The edge of the underground (author, 2023).



Figure 246: Contemplating the edge (author, 2023).

9. WALKING TOWARDS 5000



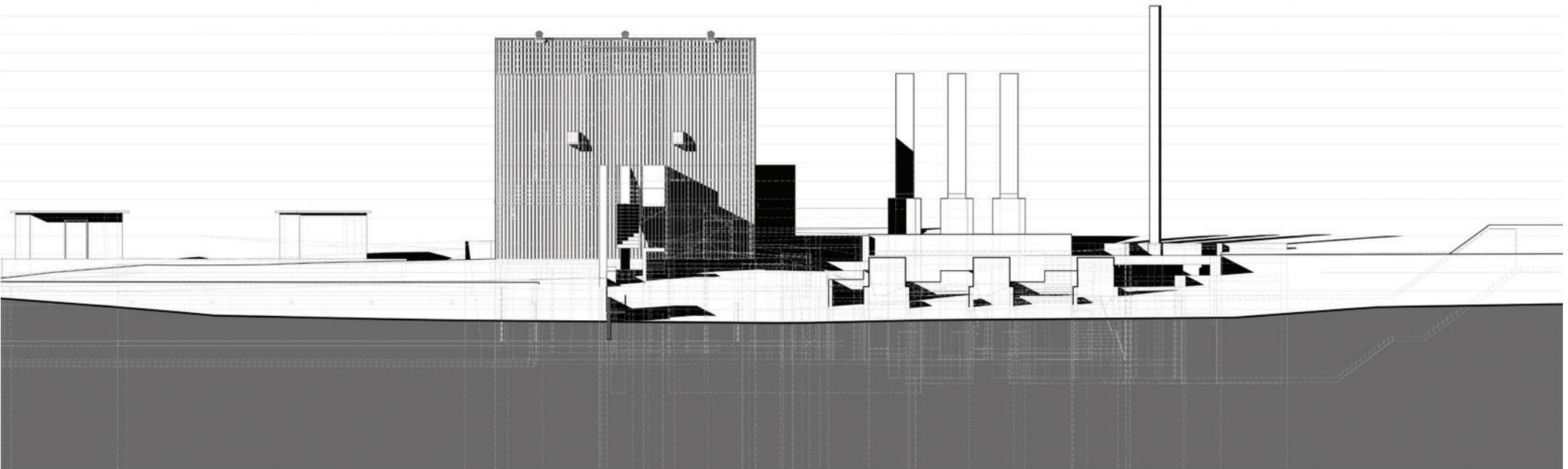


Figure 248: Breathing (author, 2023).



Figure 249: Moment of pause before venturing directly under 5000 (author, 2023).

10. EXHIBITION 5000



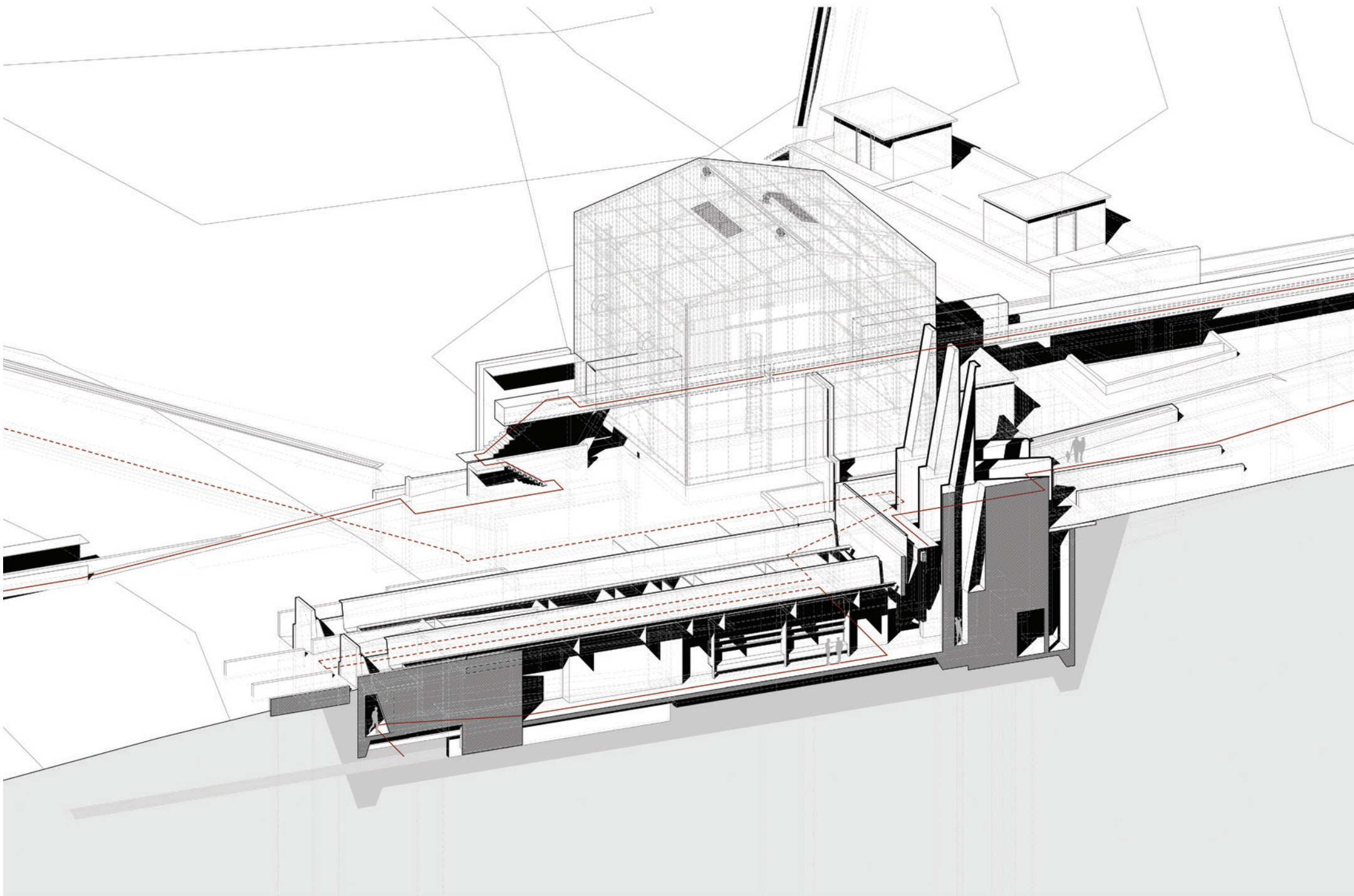
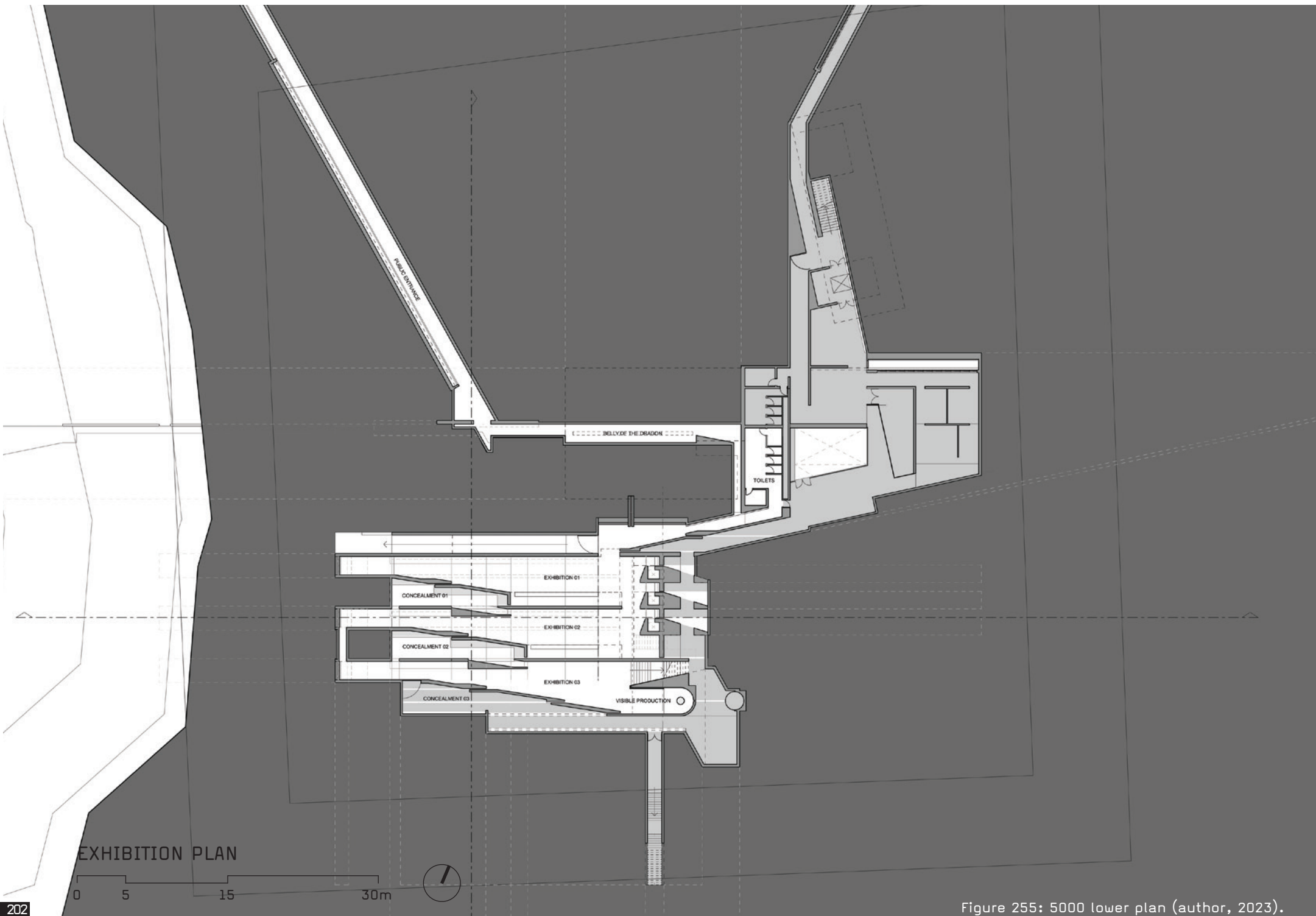


Figure 254: Movement through 5000 (author, 2023).



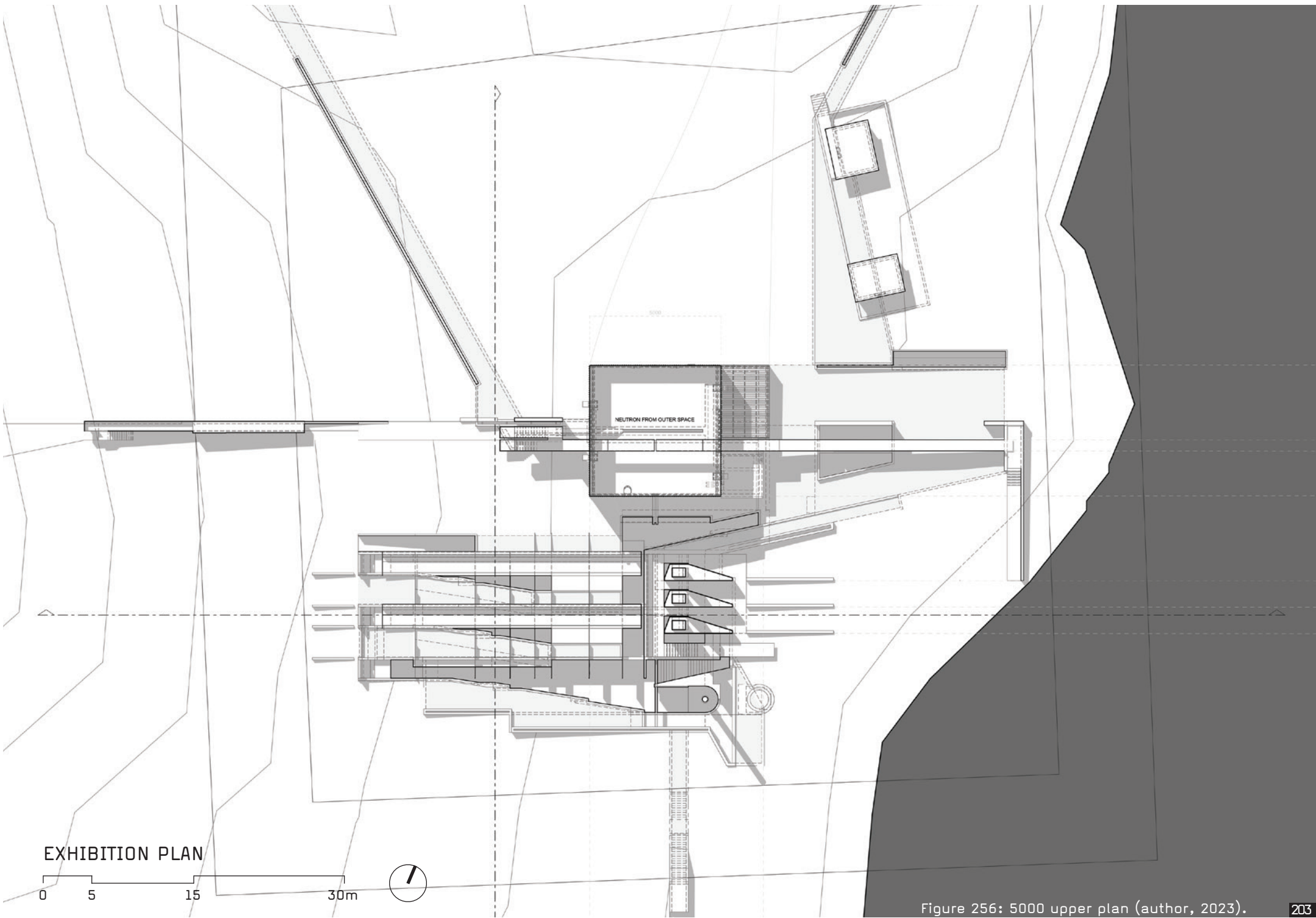
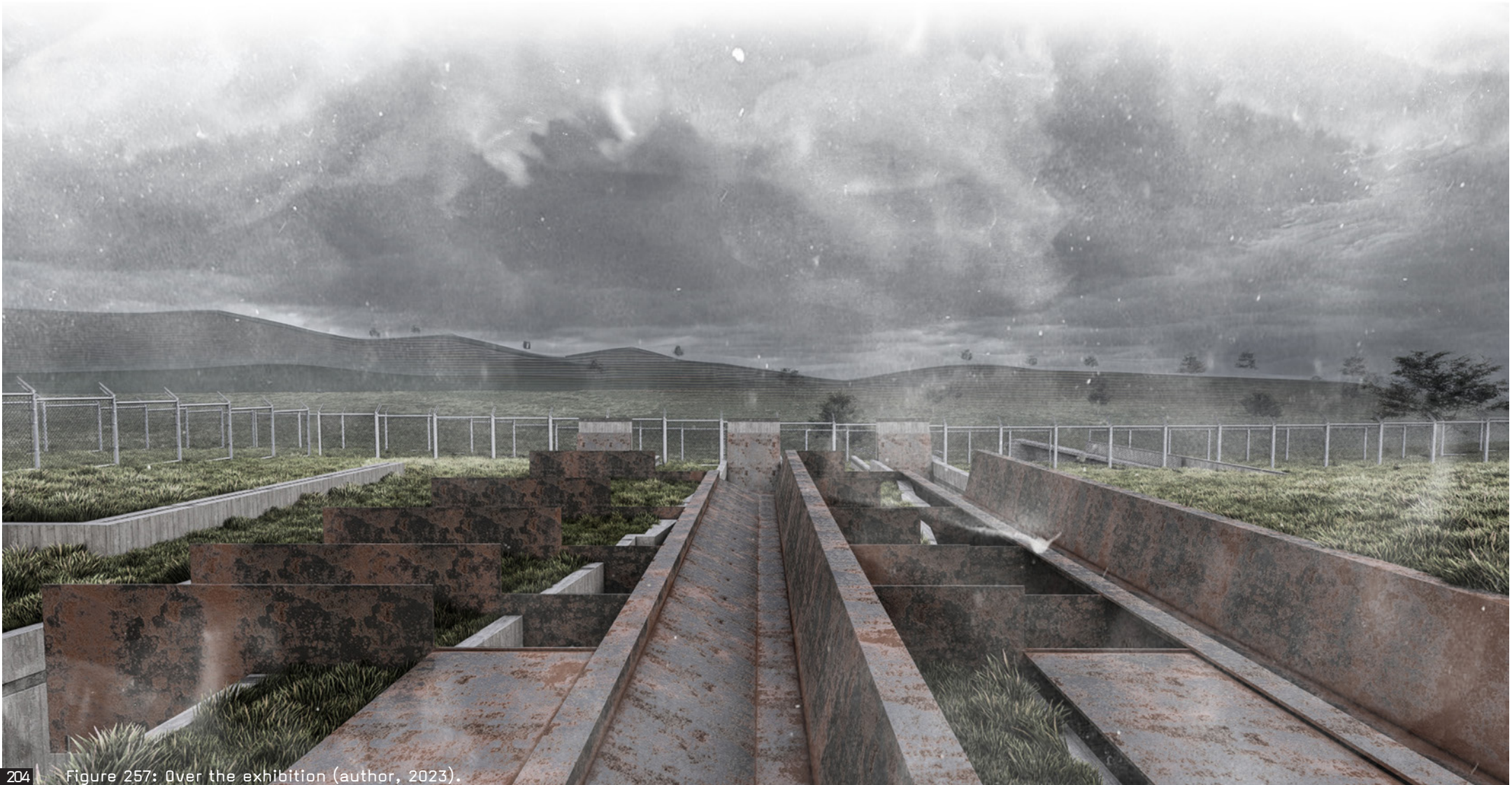
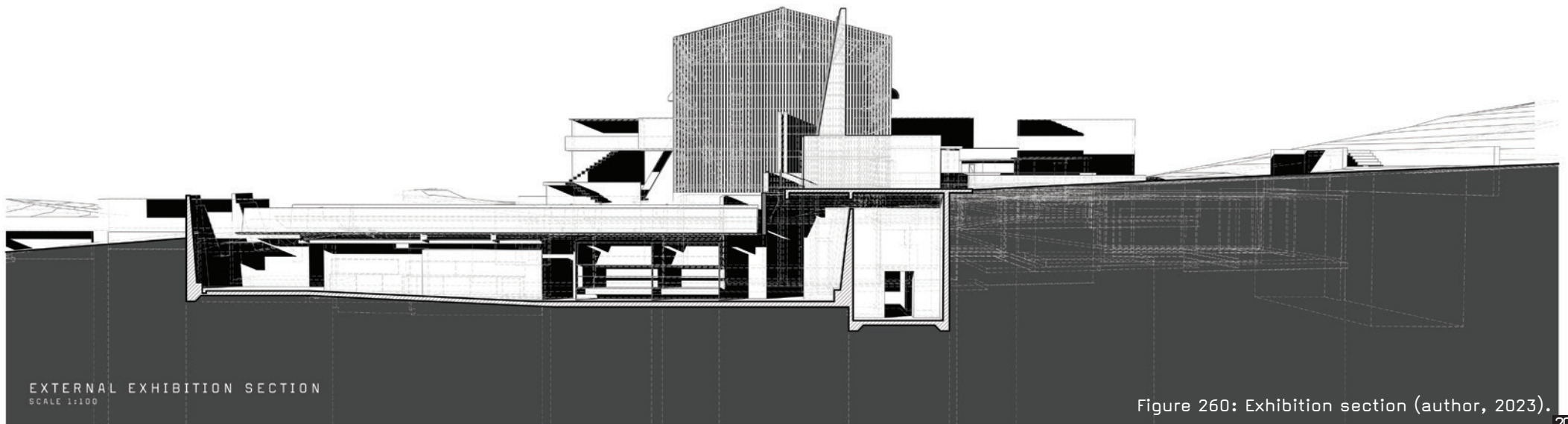


Figure 256: 5000 upper plan (author, 2023).





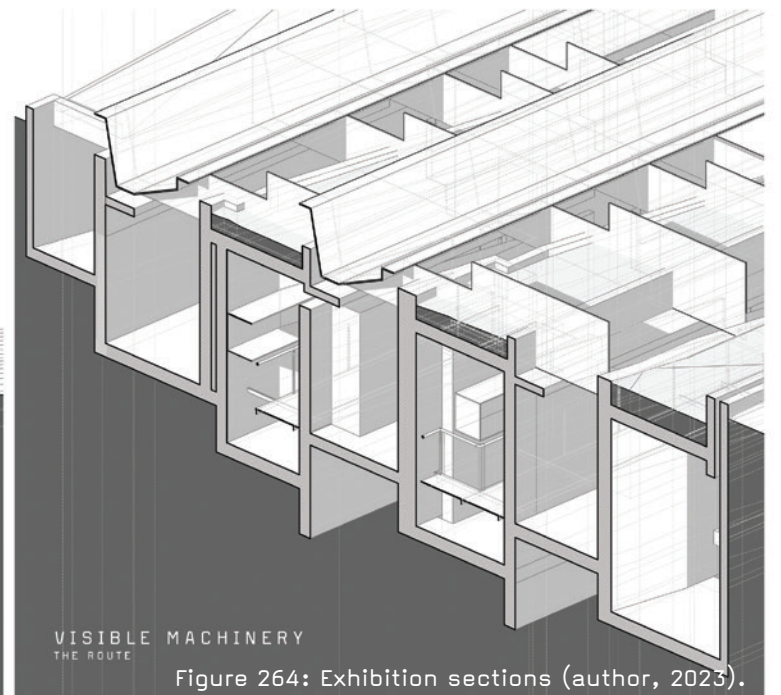
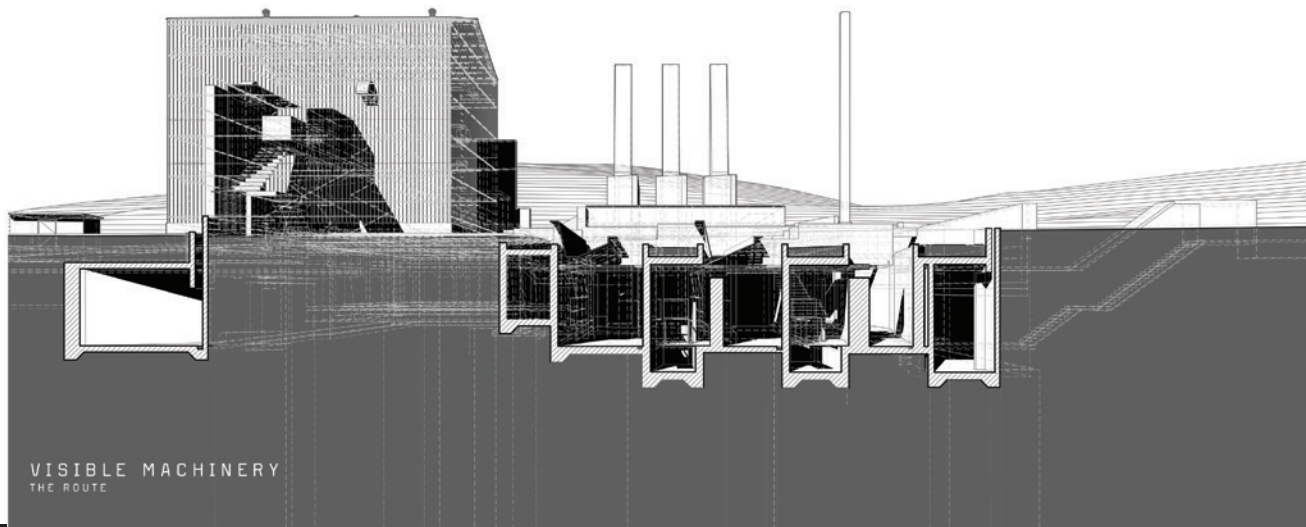




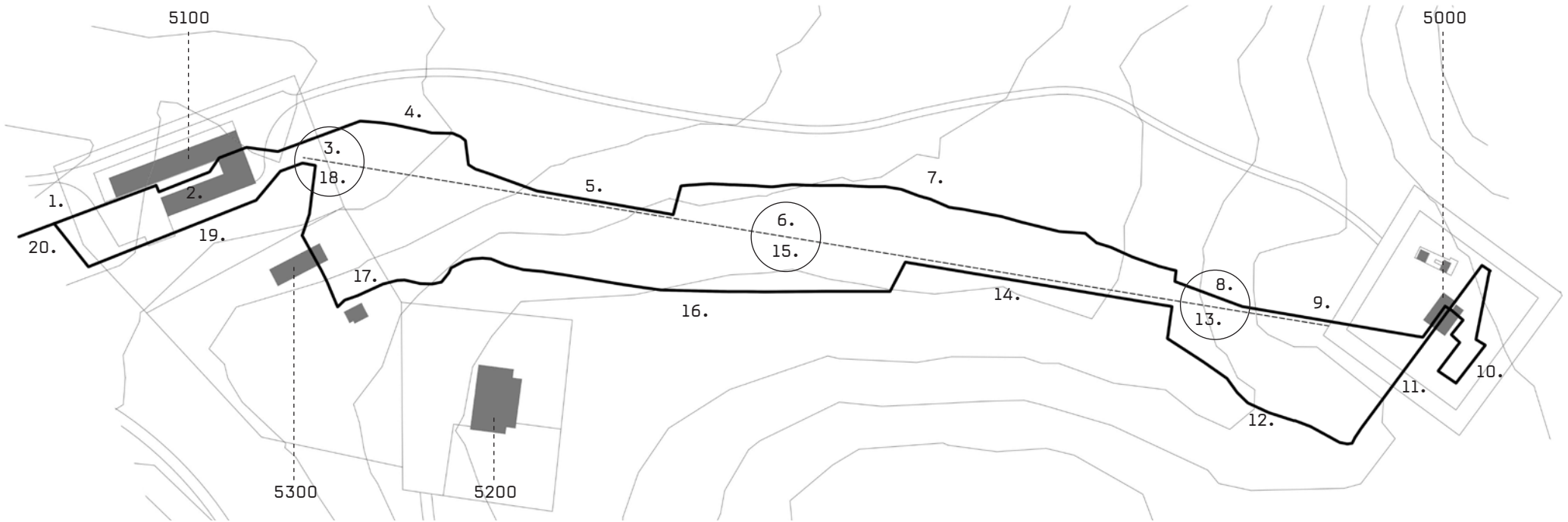
Figure 266: A look from inside the restricted production facility at 5000 (author, 2023).



Figure 267: Presentation video (author, 2023).

THE ROUTE TO:

- | | |
|-----------------------|------------------------|
| 1. Arrival | 6. Point of memory 02 |
| 2. Foundry 5100 | 7. Path |
| 3. Point of memory 01 | 8. Point of memory 03 |
| 4. Path | 9. Entering underneath |
| 5. Trench 01 | 10. Exhibition 5000 |



THE ROUTE FROM:

- | | |
|------------------------|-----------------------------------|
| 11. Exiting over | 16. Path |
| 12. Path | 17. Path through other structures |
| 13. Point of memory 03 | 18. Point of memory 01 |
| 14. Trench 02 | 19. Foundry 5100 |
| 15. Point of memory 02 | 20. Departure |

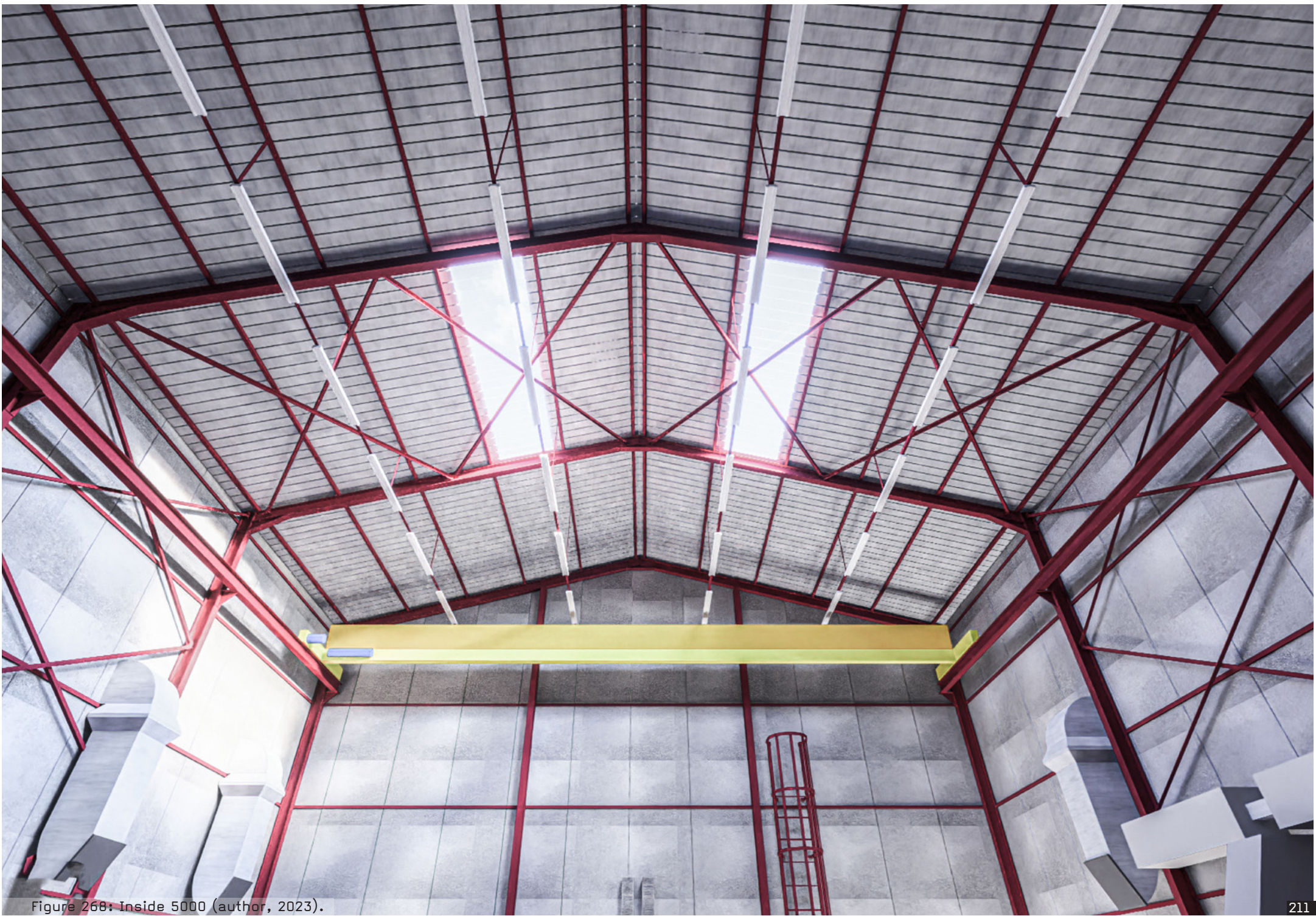
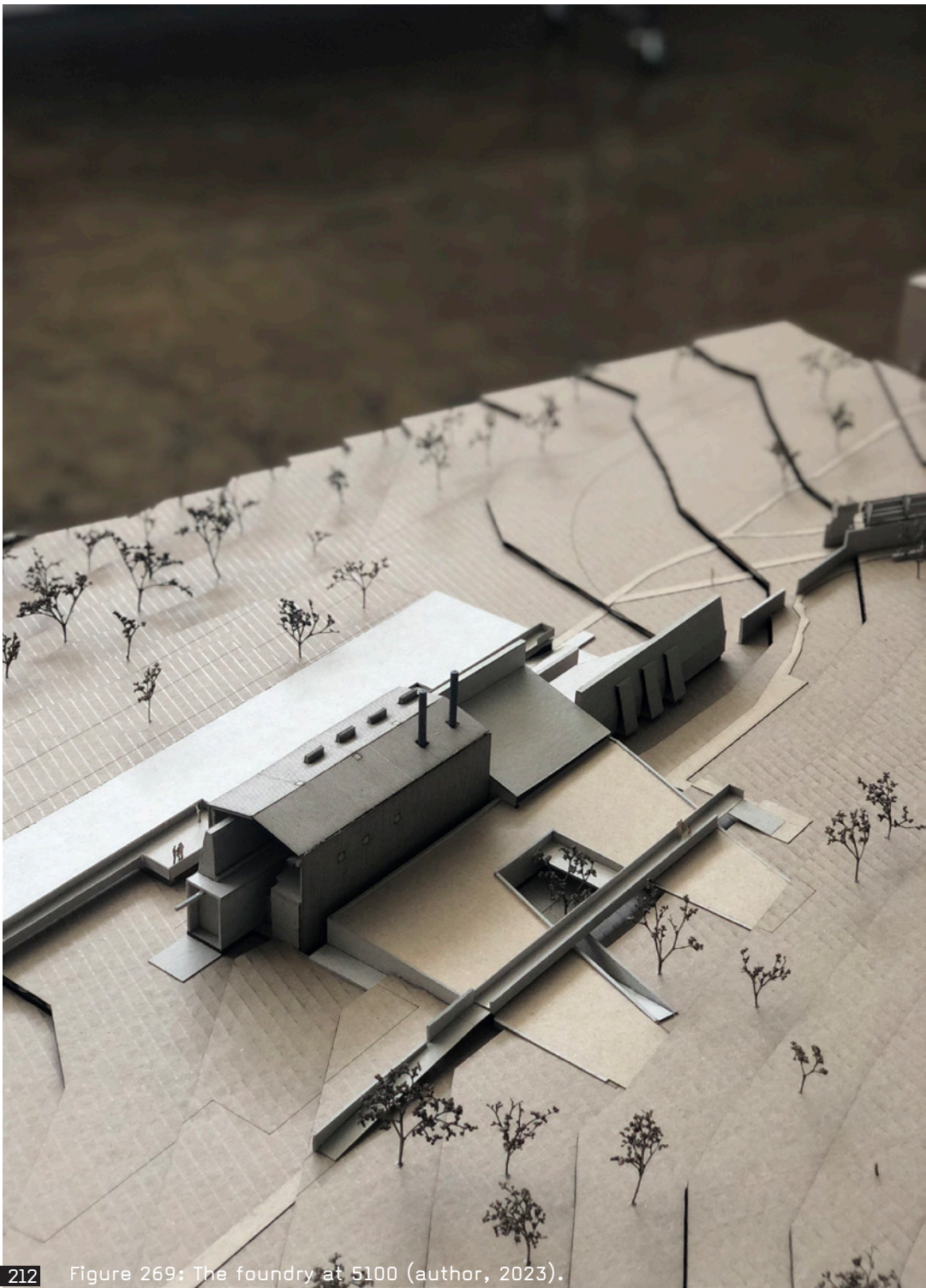


Figure 268: Inside 5000 (author, 2023).



212 Figure 269: The foundry at 5100 (author, 2023).

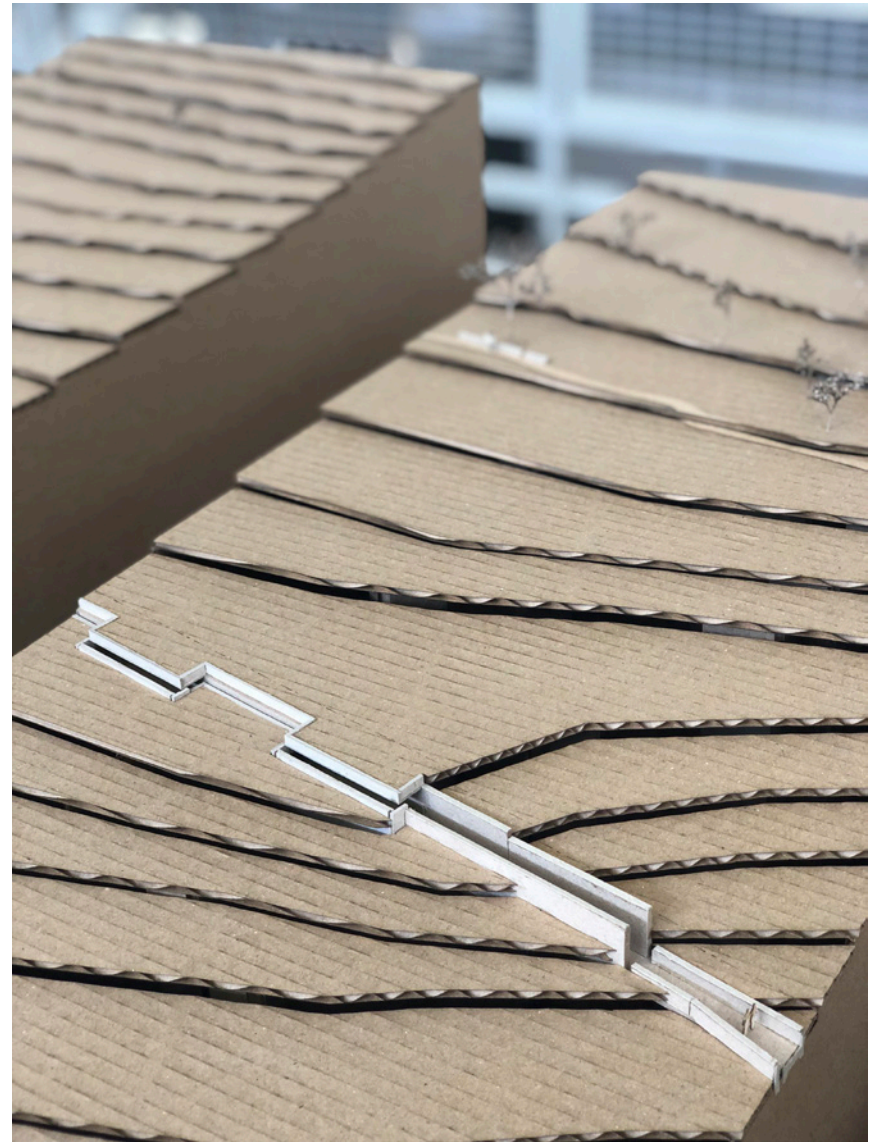


Figure 270: Trench 01 (author, 2023).



Figure 271: Trench 02 (author, 2023).

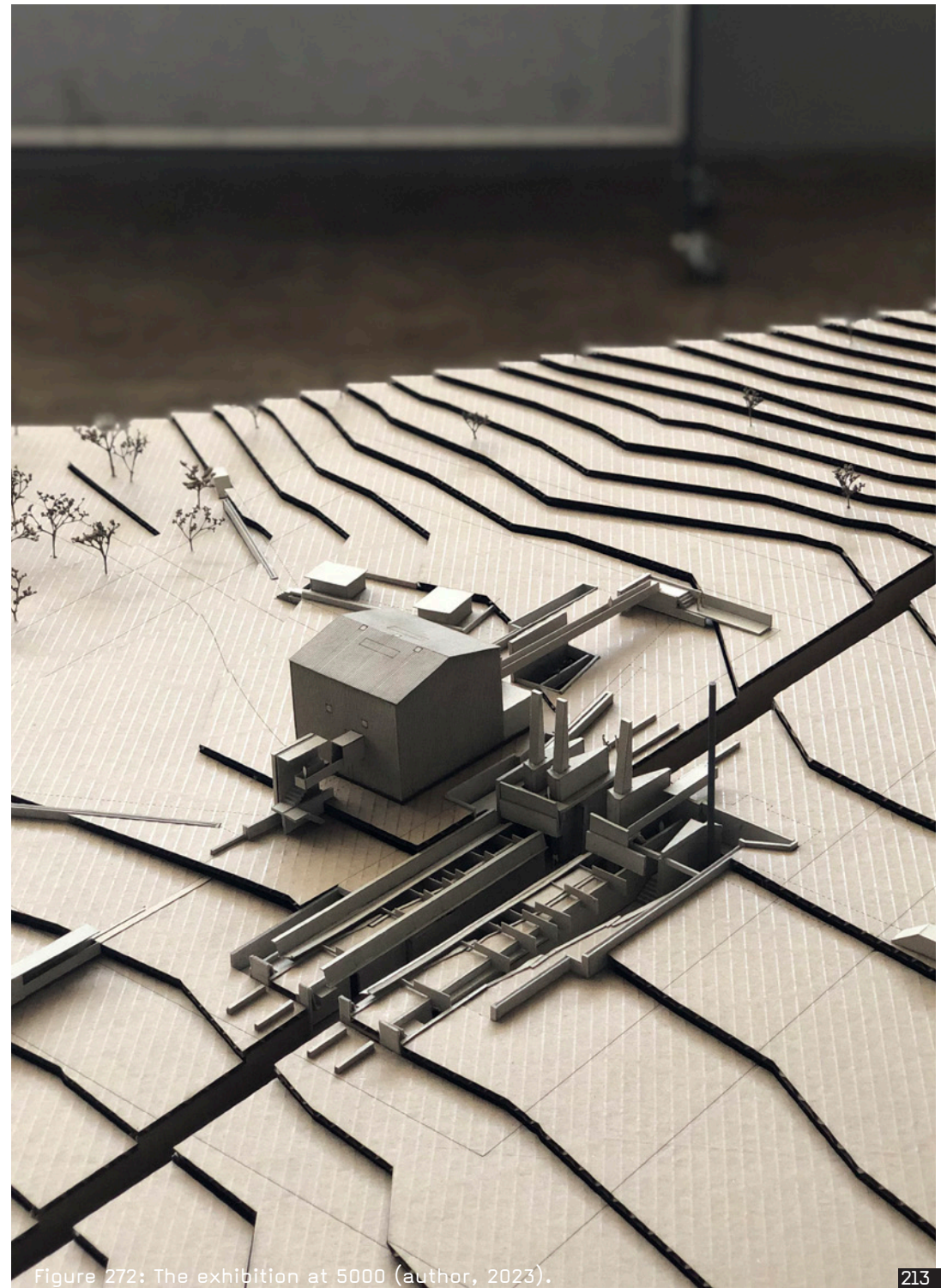
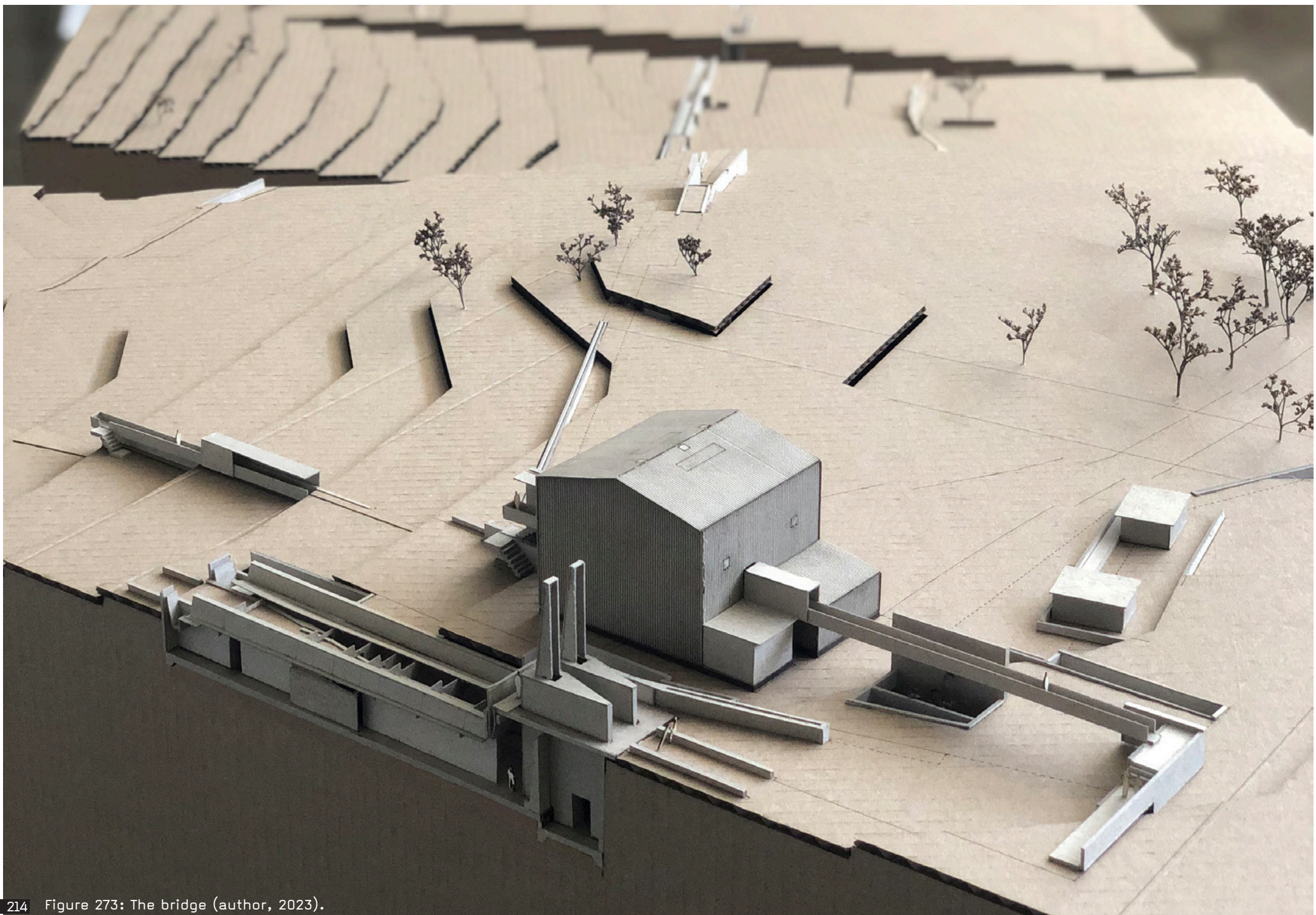


Figure 272: The exhibition at 5000 (author, 2023).



214 Figure 273: The bridge (author, 2023).

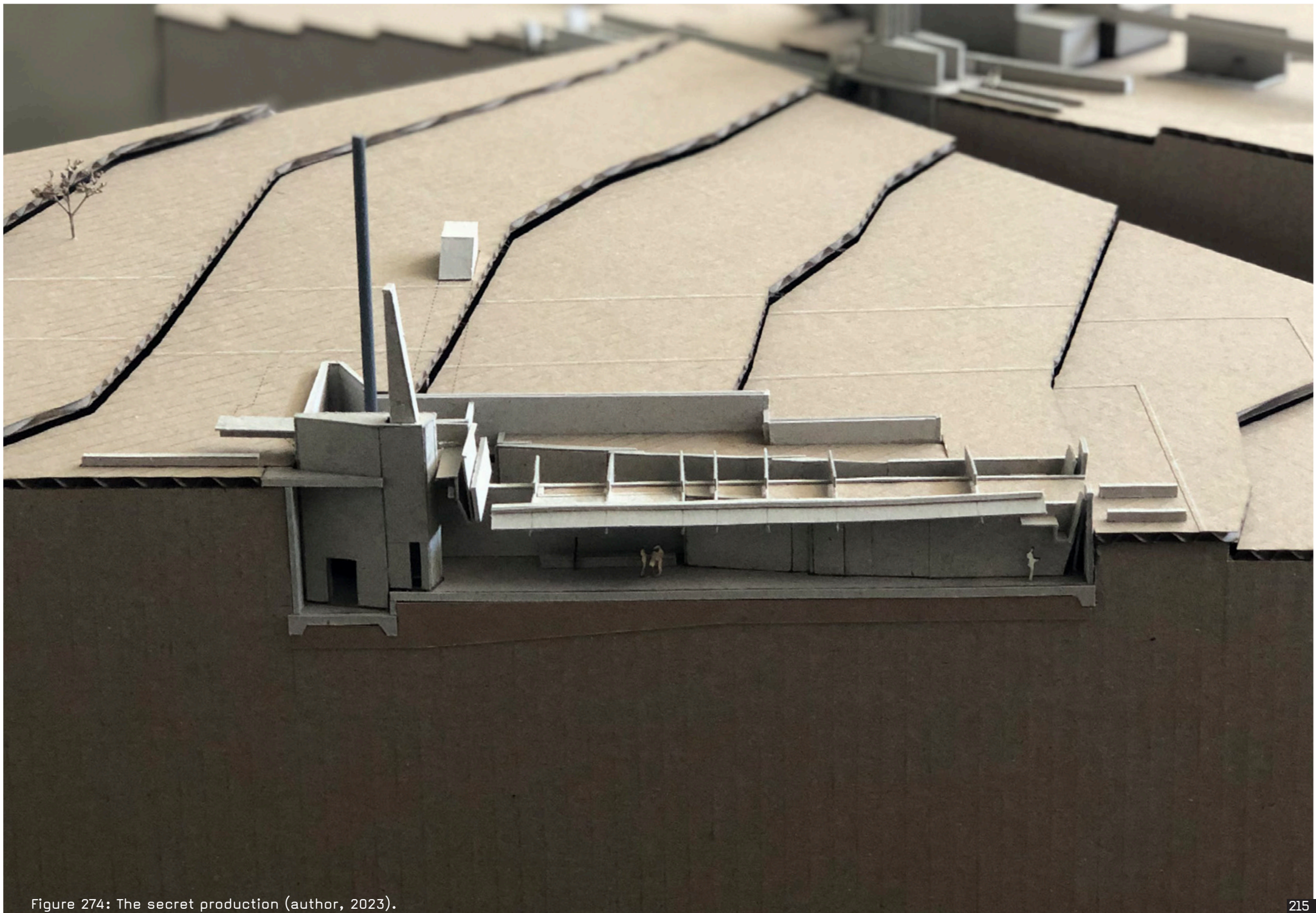
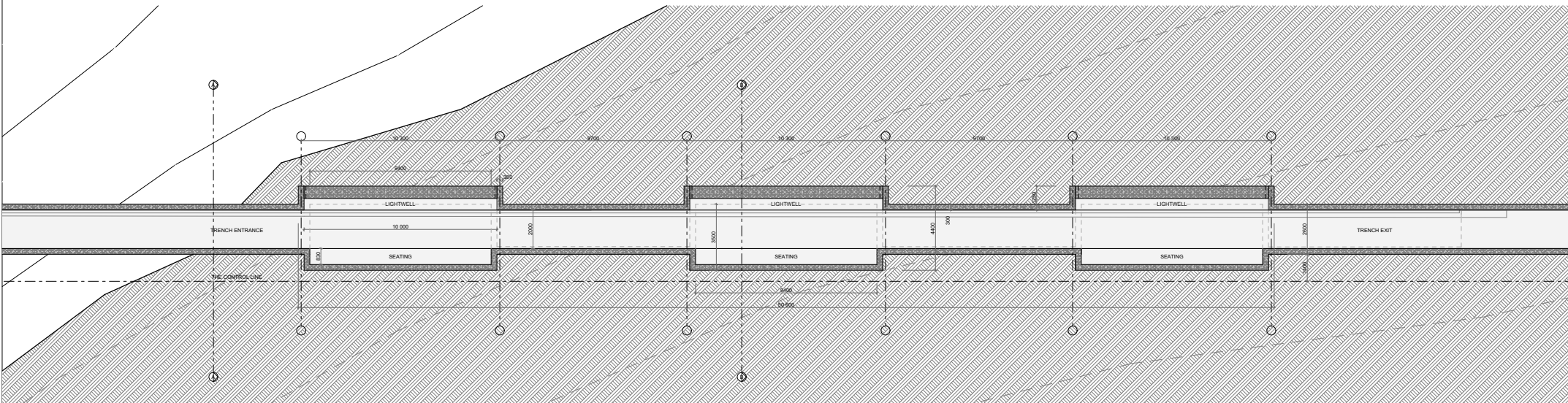
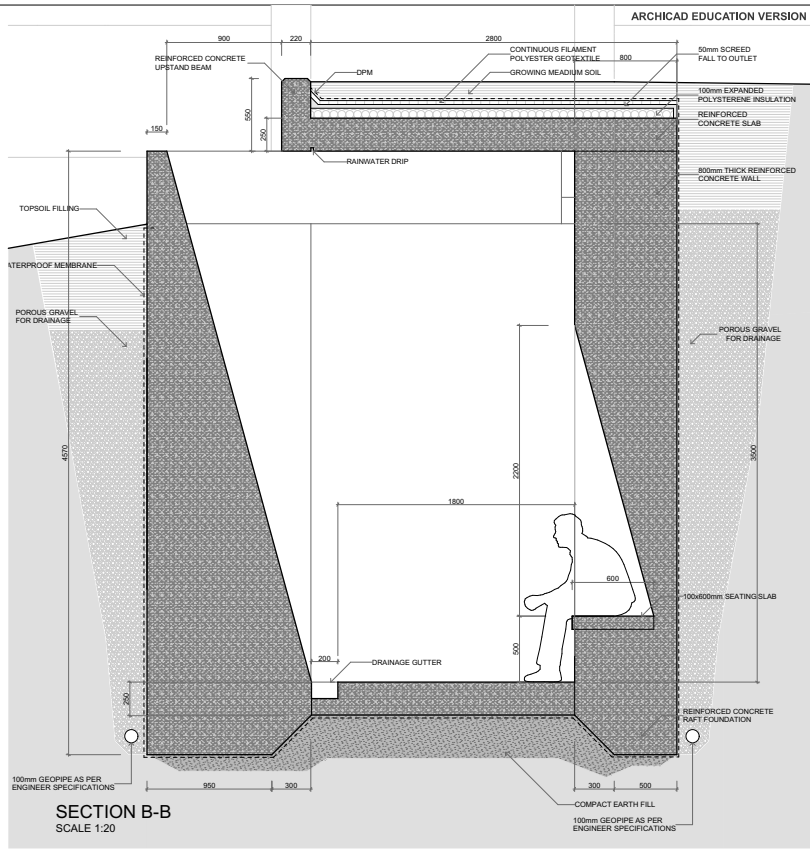
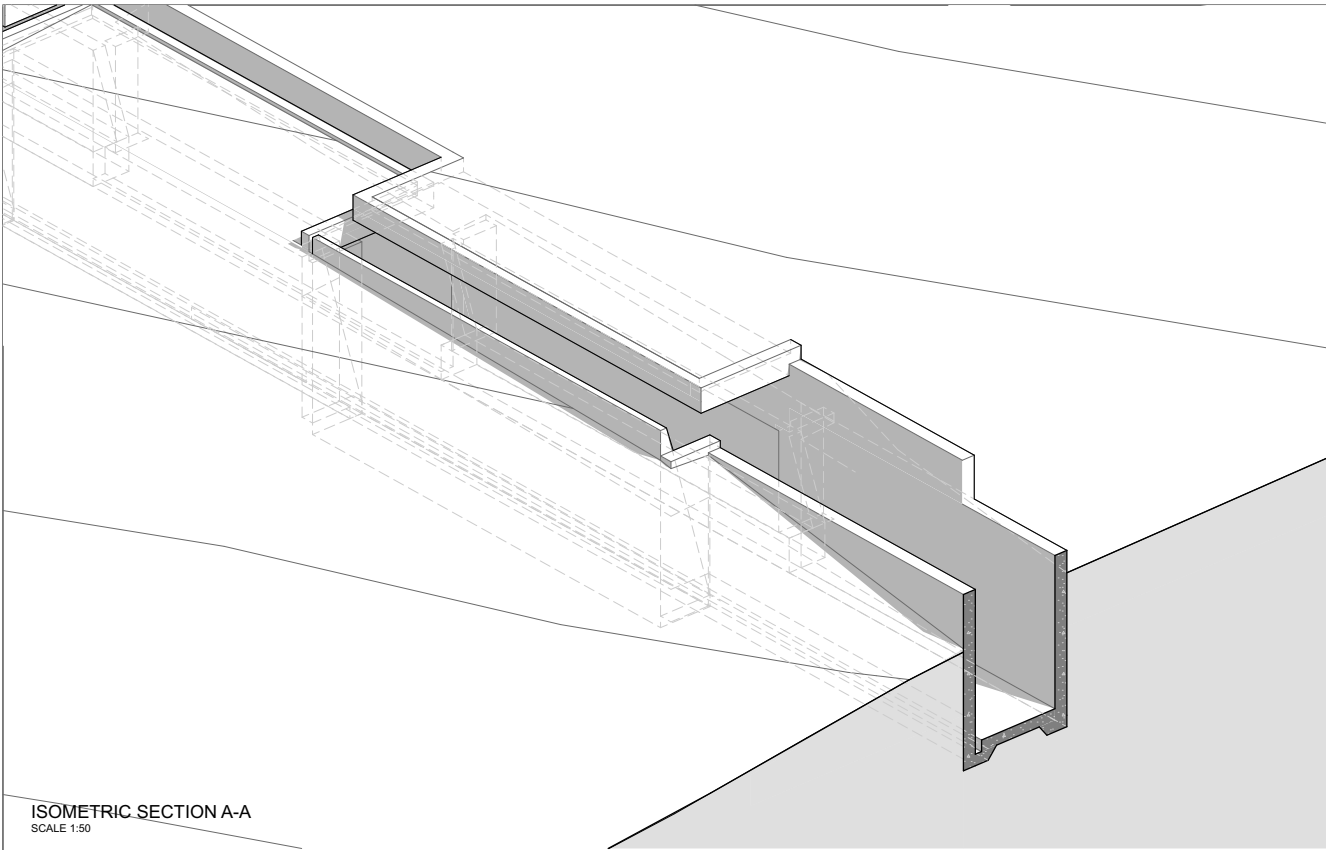


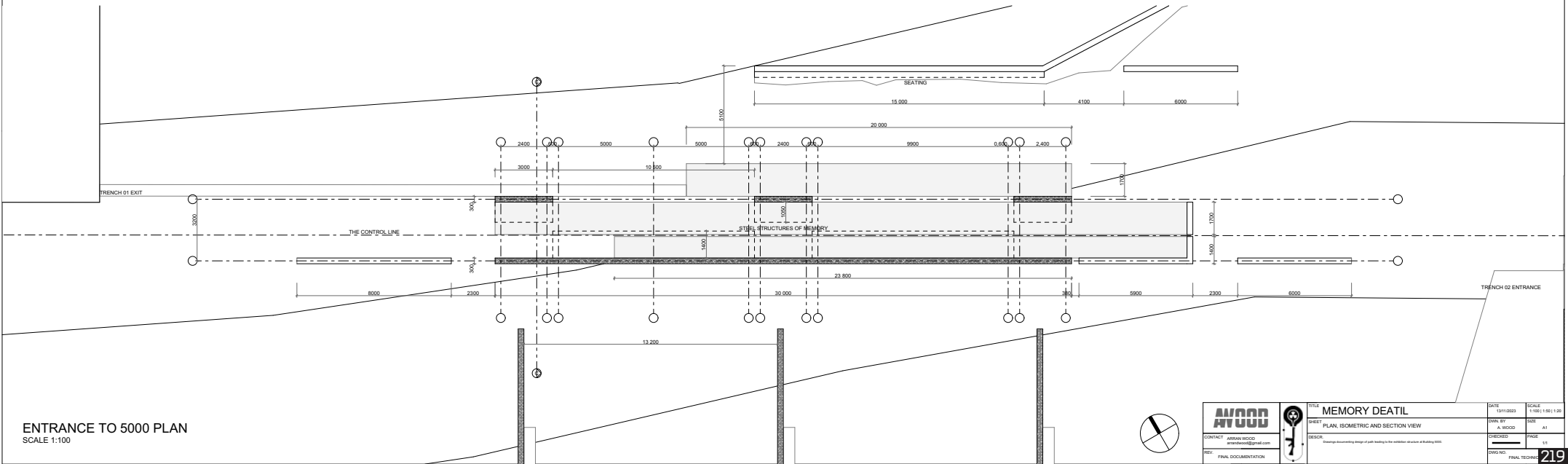
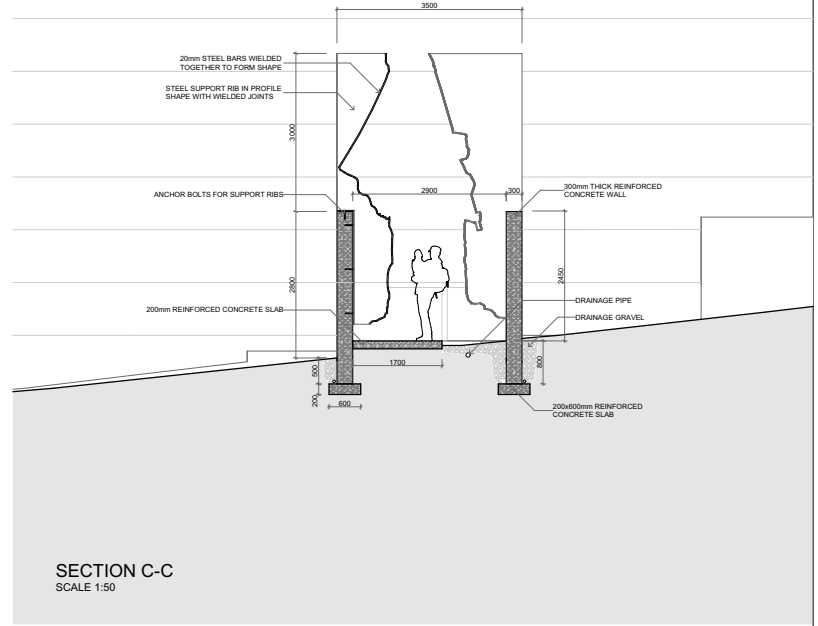
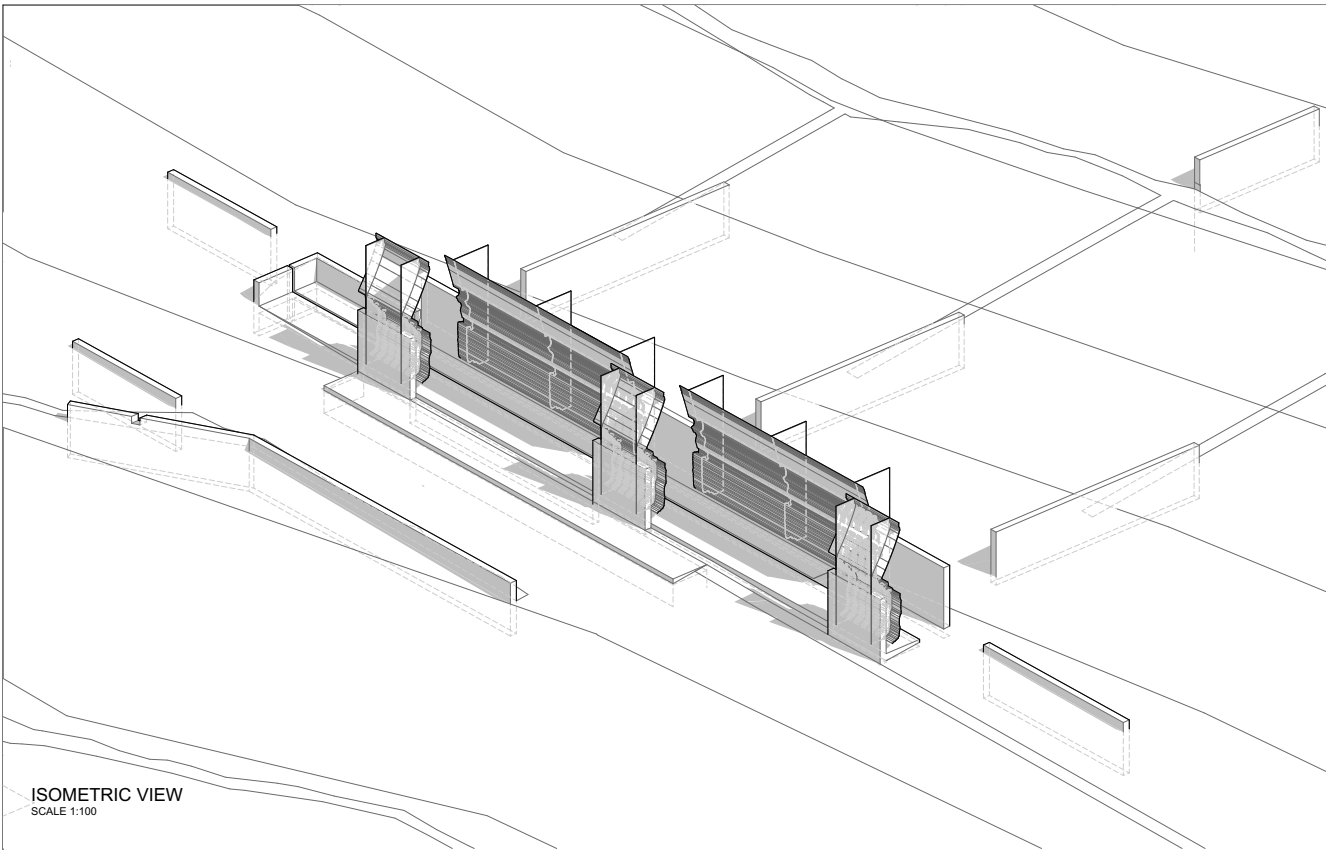
Figure 274: The secret production (author, 2023).

8.4 FINAL CONSTRUCTION

The next section unpacks the final documentation drawings of the new design. Each set of drawings corresponds to a location along the route. Specific points have been chosen and culminate in the drawings of the exhibition structure at Building 5000.



<p>CONTACT: ARIANA WOOD ariawood@studios.com</p> <p>REV: FINAL DOCUMENTATION</p>	<p>TITLE: TRENCH 01 DETAIL</p> <p>DRAWN BY: A.W.</p> <p>DESIGN: A.W.</p>	<p>DATE: 15/11/2023</p> <p>SCALE: 1:100 (1:50) 1:20</p> <p>DATE: 15/11/2023</p> <p>SCALE: A1</p> <p>DATE: 15/11/2023</p> <p>SCALE: 1:1</p>
	<p>PROJECT: PLAN AND SECTION VIEW</p> <p>DESIGN: (Empty)</p>	<p>REV: FINAL TECHNICAL</p>



WOOD
HYDRO

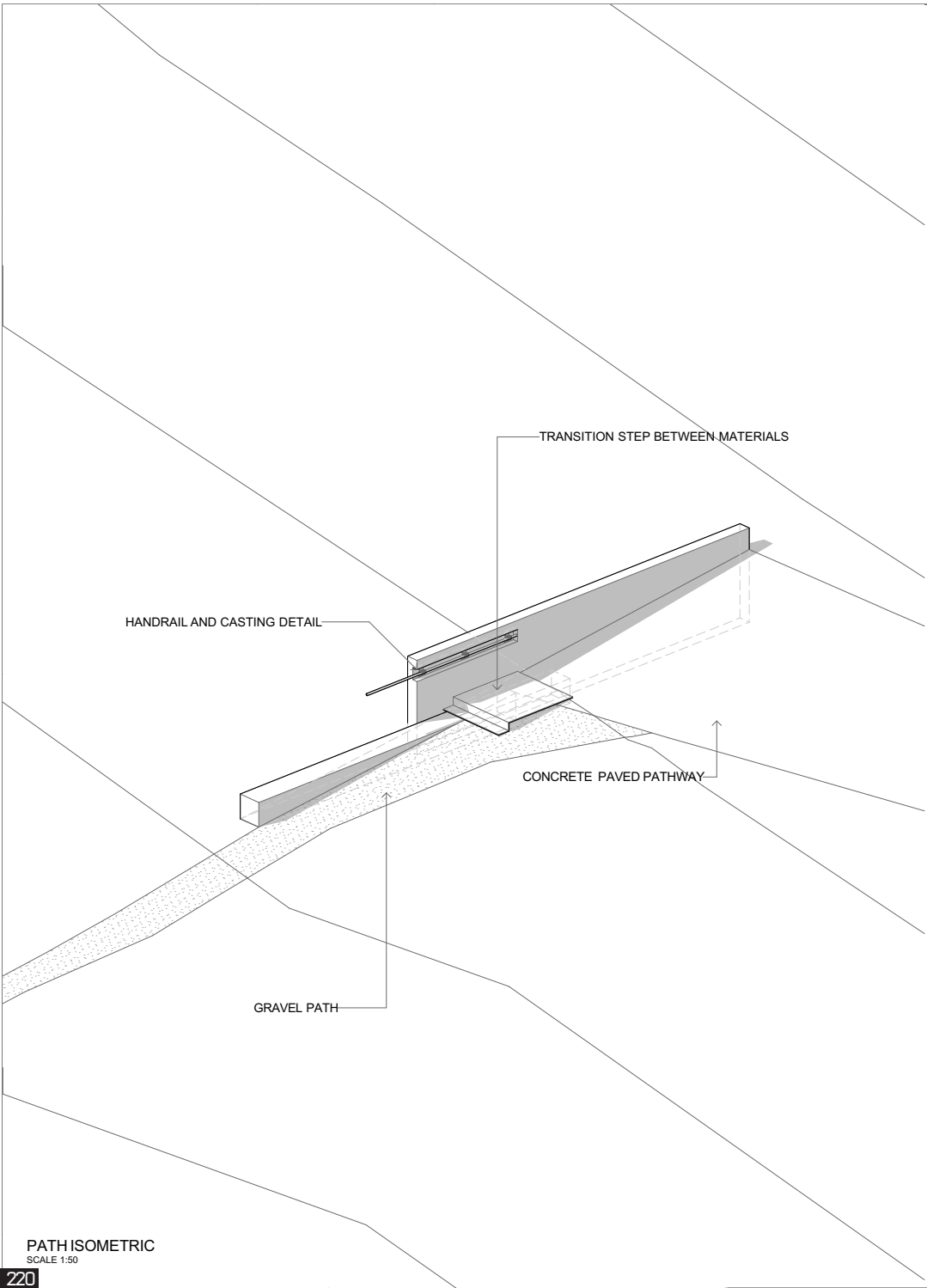
CONTACT: ARIANA WOOD
ariawood@sigraf.com

REV: FINAL DOCUMENTATION

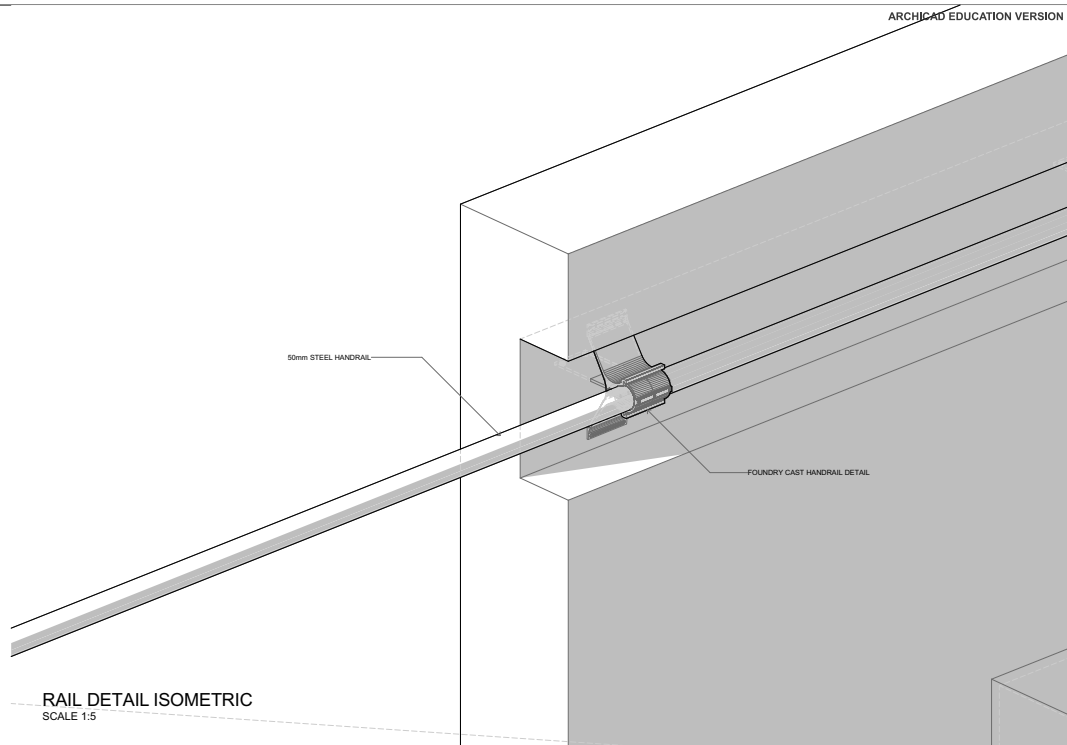


TITLE: MEMORY DEATH
PROJECT: PLAN, ISOMETRIC AND SECTION VIEW
DESIGN: Designing documentary design of path leading to the exhibition structure at 5000 1000

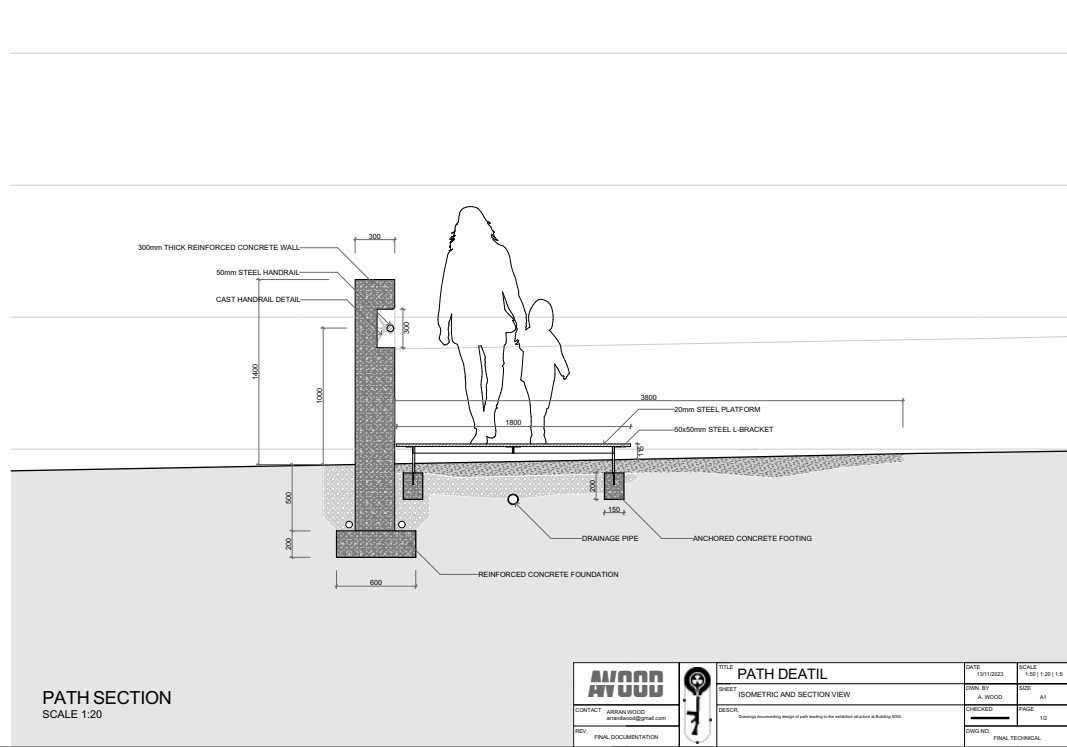
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DRAWN BY: A.WOOD	SIZE: A1
CHECKED: []	DATE: 1/11
PROJECT NO.: []	FINAL TECH: 219



PATH ISOMETRIC
SCALE 1:50

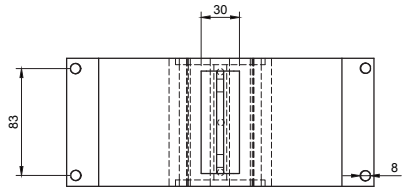


RAIL DETAIL ISOMETRIC
SCALE 1:5

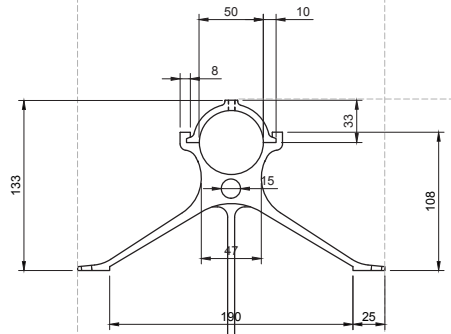


PATH SECTION
SCALE 1:20

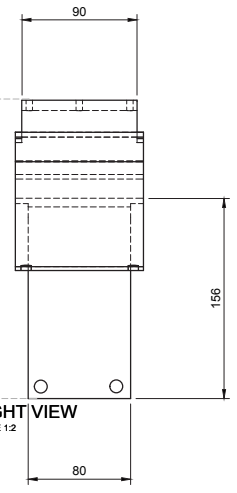
<p>CONTACT: ARIANA WOOD ariawood@gmail.com</p> <p>REV: FINAL DOCUMENTATION</p>	<p>TITLE: PATH DETAIL</p> <p>DATE: 15/11/2023</p> <p>SCALE: 1:50 1:20 1:5</p>
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	<p>DESIGNED: A.WOOD</p> <p>DATE: 12</p>
	<p>PROJECT NO.: FINAL TECHNICAL</p>



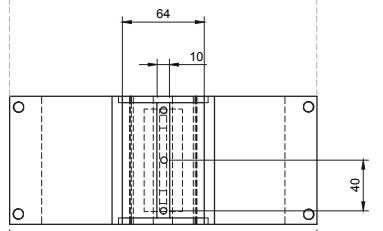
BOTTOM VIEW
SCALE 1:2



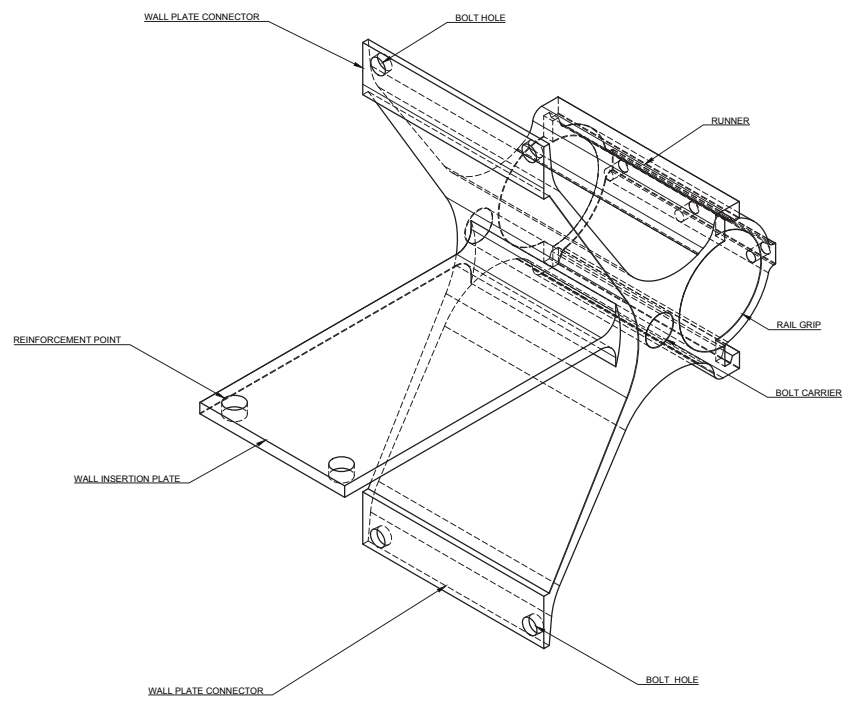
FRONT VIEW
SCALE 1:2



RIGHT VIEW
SCALE 1:2

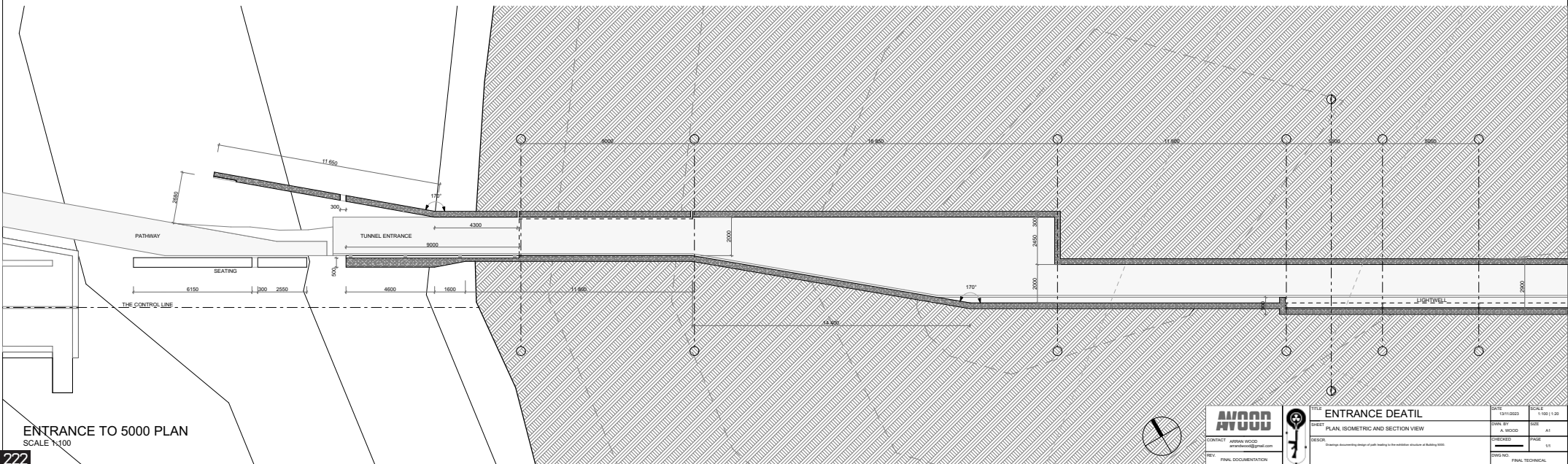
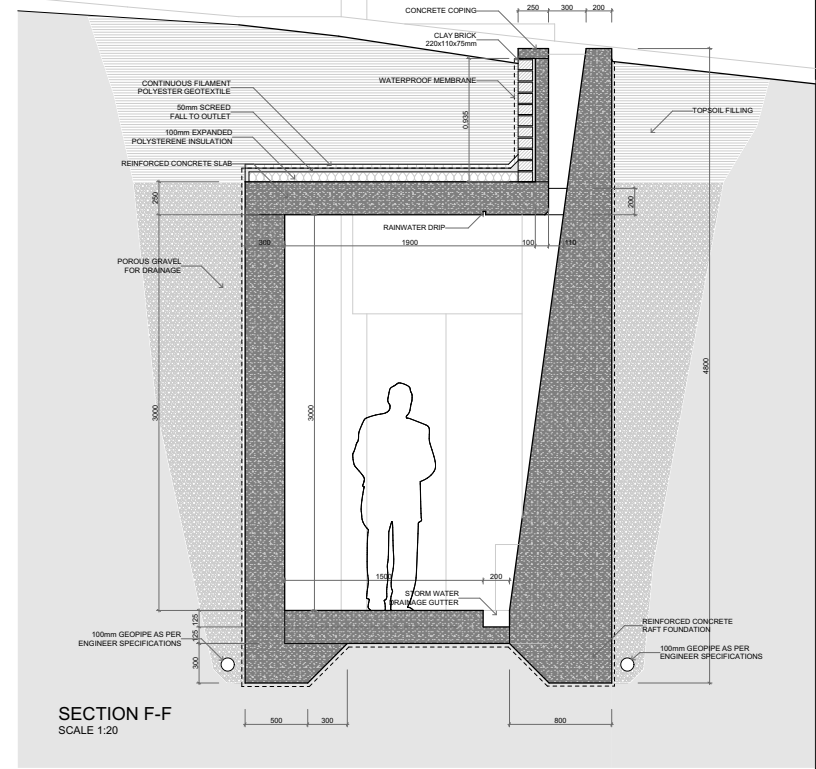
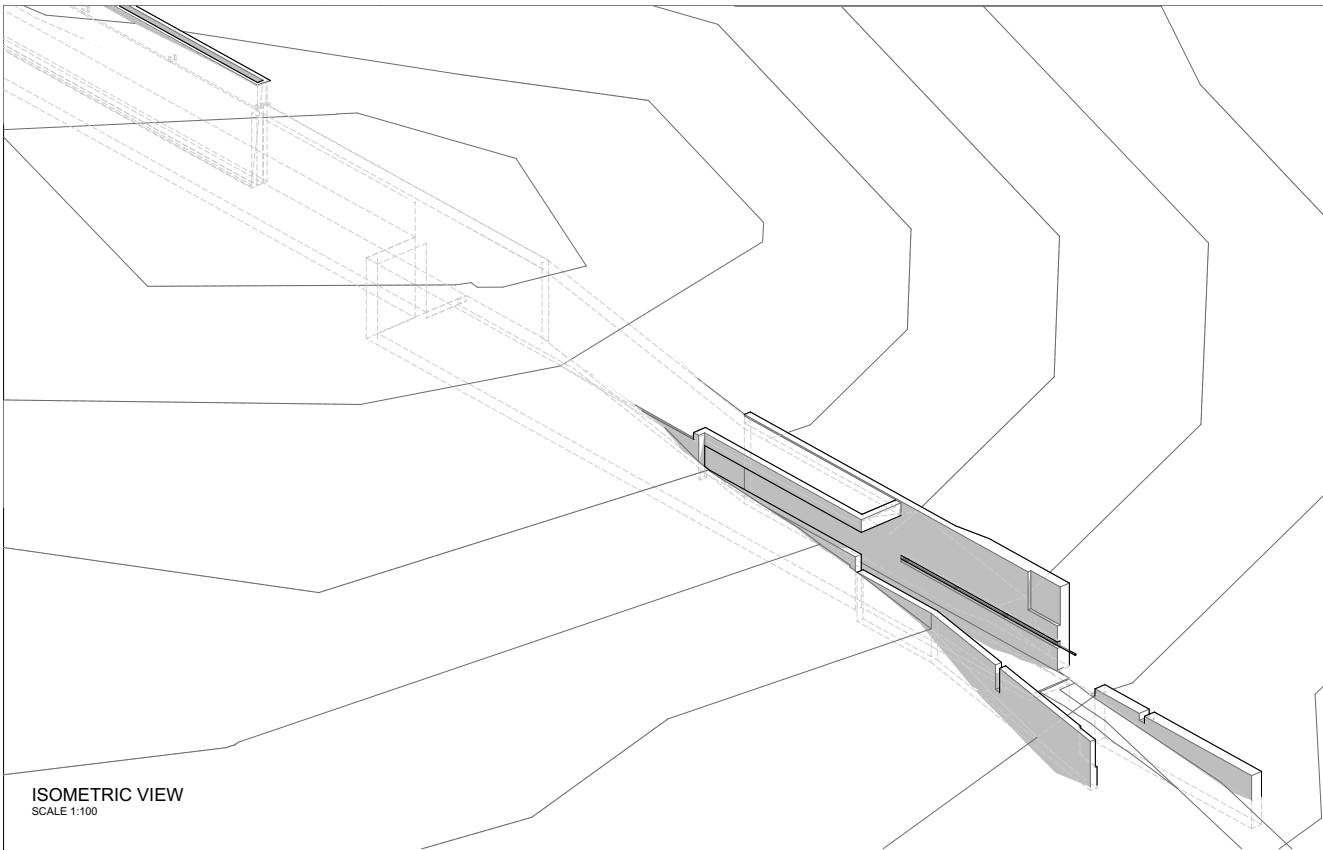


TOP VIEW
SCALE 1:2

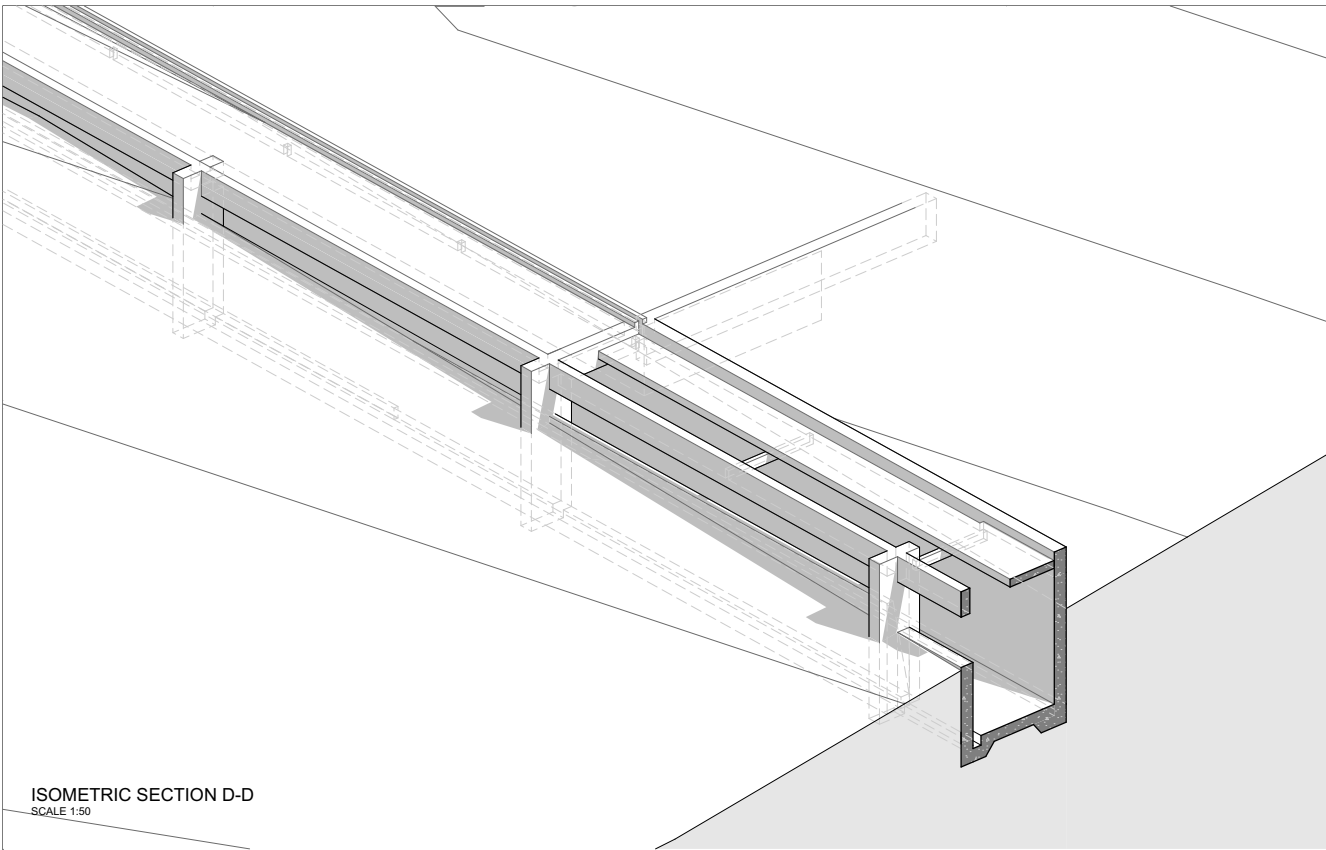


ISOMETRIC VIEW
SCALE 1:1

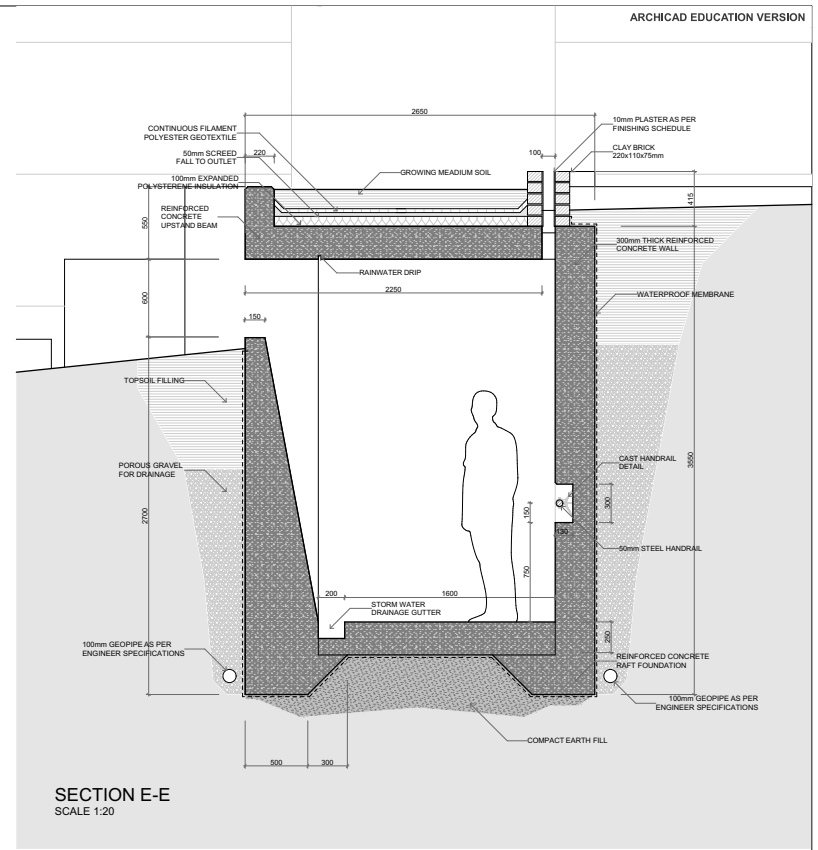
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		Document type SPECIFICATIONS		Document status IN PRODUCTION	
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Rev		Date of issue		Sheet	
N/A		N/A		1 of 1	



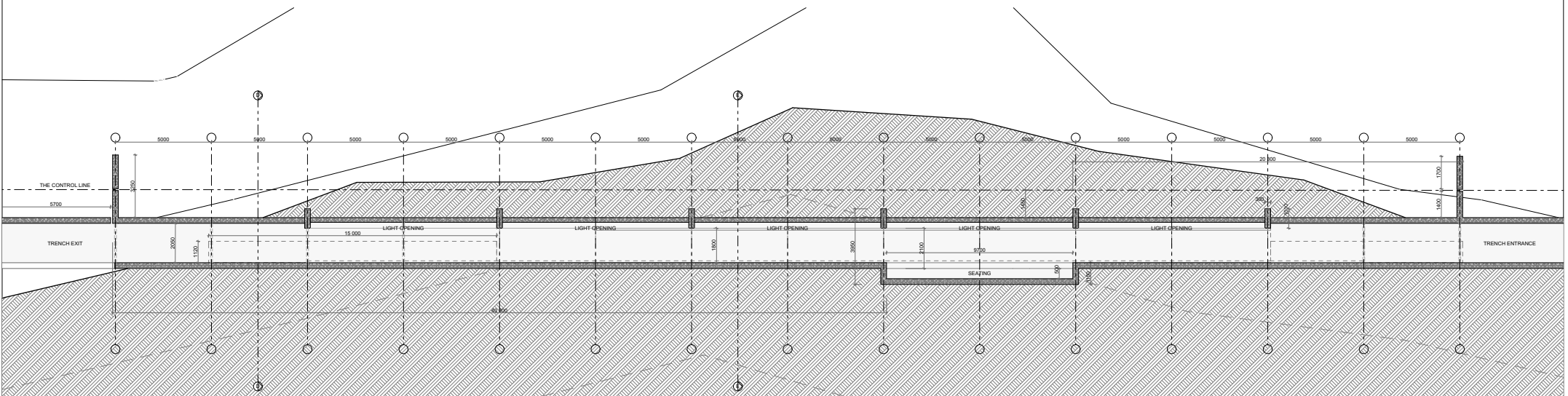
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CONTACT: ARIAN WOOD ariandesign@gmail.com		SHEET: PLAN, ISOMETRIC AND SECTION VIEW		DRAWN BY: A. WOOD	SIZE: A1
REV: FINAL DOCUMENTATION		DESIGN: Ariandesign (design & draft building for the addition structure at Building 5000)		CHECKED: _____	PAGE: 1/1
				DWG NO: _____	FINAL TECHNICAL



ISOMETRIC SECTION D-D
SCALE 1:50



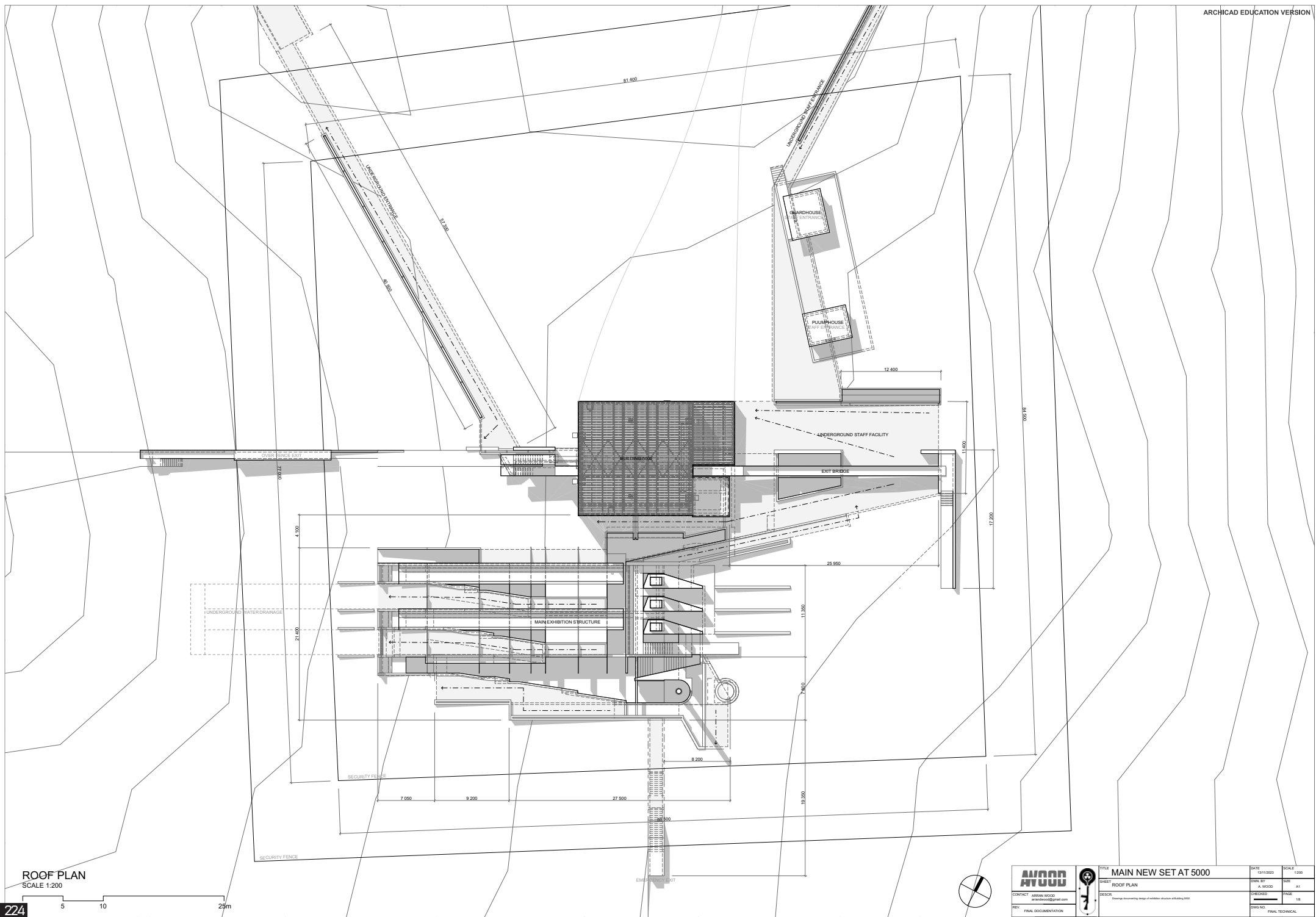
SECTION E-E
SCALE 1:20



TRENCH 02 PLAN
SCALE 1:100



WOOD CONTACT: ARIAN WOOD arian@woodgroup.com		TRENCH 02 DEATIL PLAN AND SECTION VIEW		DATE: 15/10/2023 DRAWN BY: A.WOOD CHECKED: [] DESIGNED BY: []	SCALE: 1:100 (1:50) (1:20) SHEET: A1 PAGE: 11 PROJECT: FINAL TECHNIQUE
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ROOF PLAN
SCALE 1:200



	TITLE	MAIN NEW SET AT 5000	DATE	13/11/2023	SCALE	1:200
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	DESIGNER	DESIGN	CHECKED		PAGE	18
	REV.	FINAL DOCUMENTATION	DWG NO.			FINAL TECHNICAL

CONTACT: ARIAN WOOD
ari@wood.com

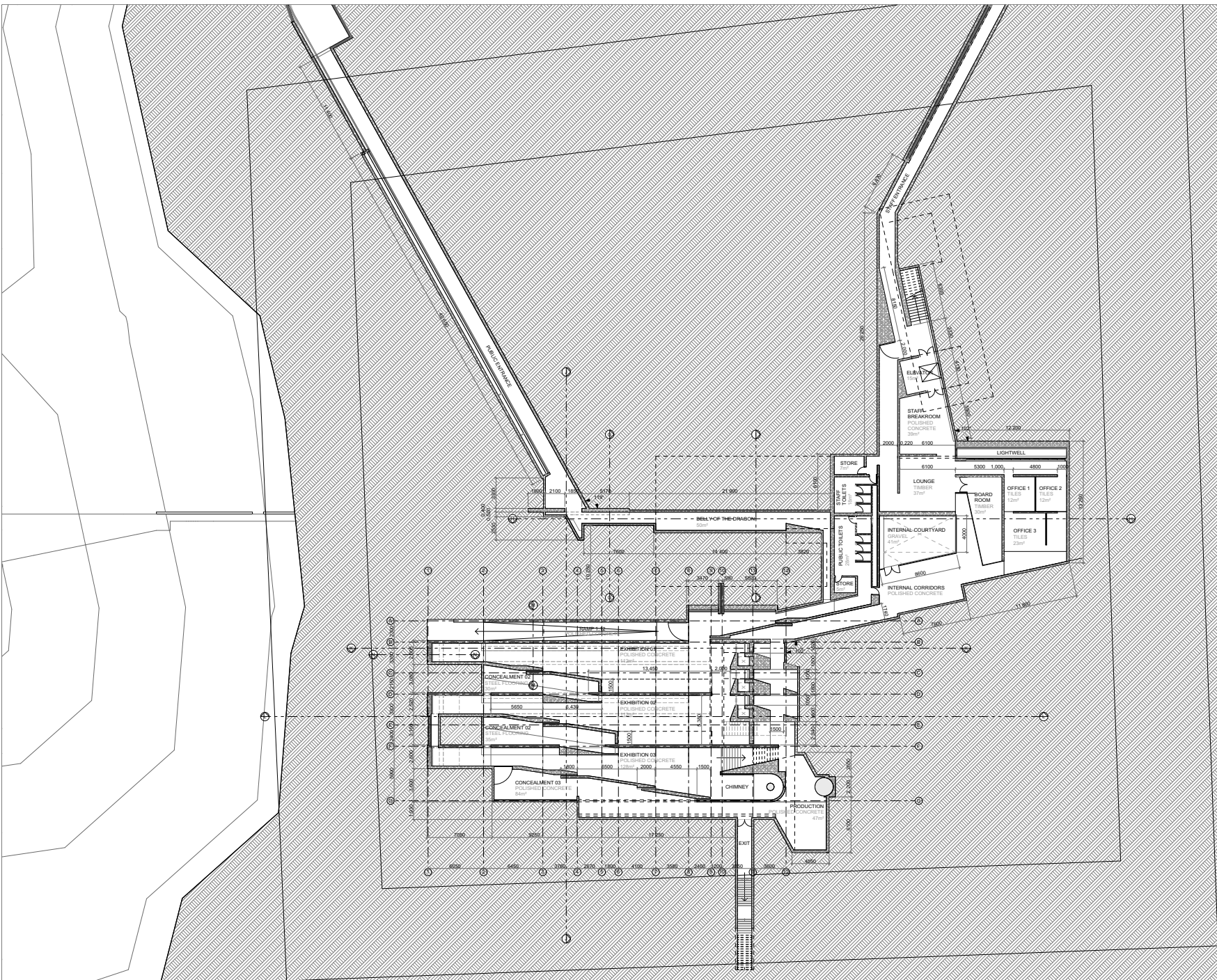
Developed according to design of exhibition structure at Building 5000



GROUND FLOOR PLAN
SCALE 1:200



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	SHEET GROUND FLOOR PLAN		DRAW BY A. WOOD	DATE
	DESCR. Develop according to the program of additional structure of Building 5000		CHECKED	PAGE 1/1
	REV. FINAL DOCUMENTATION		DWG. NO.	FINAL TECH.

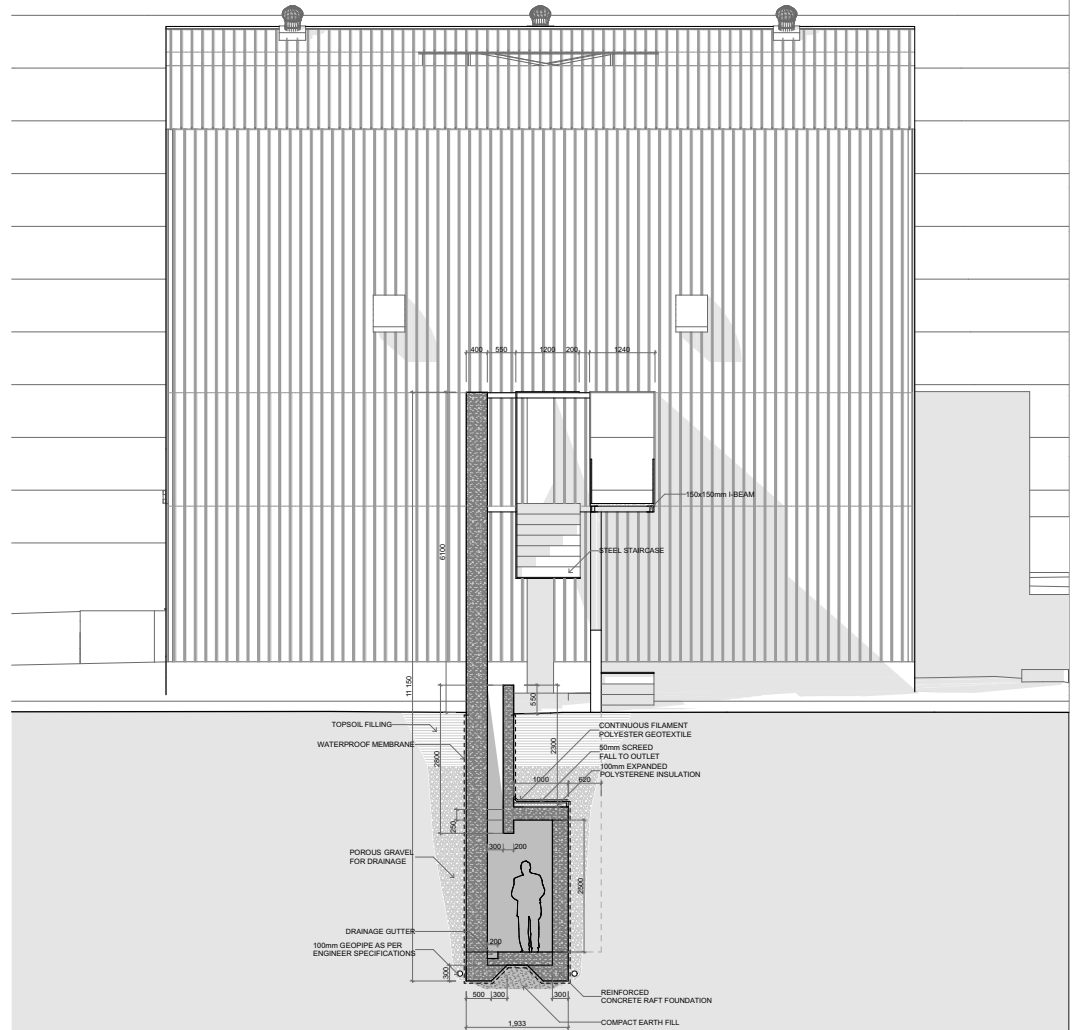
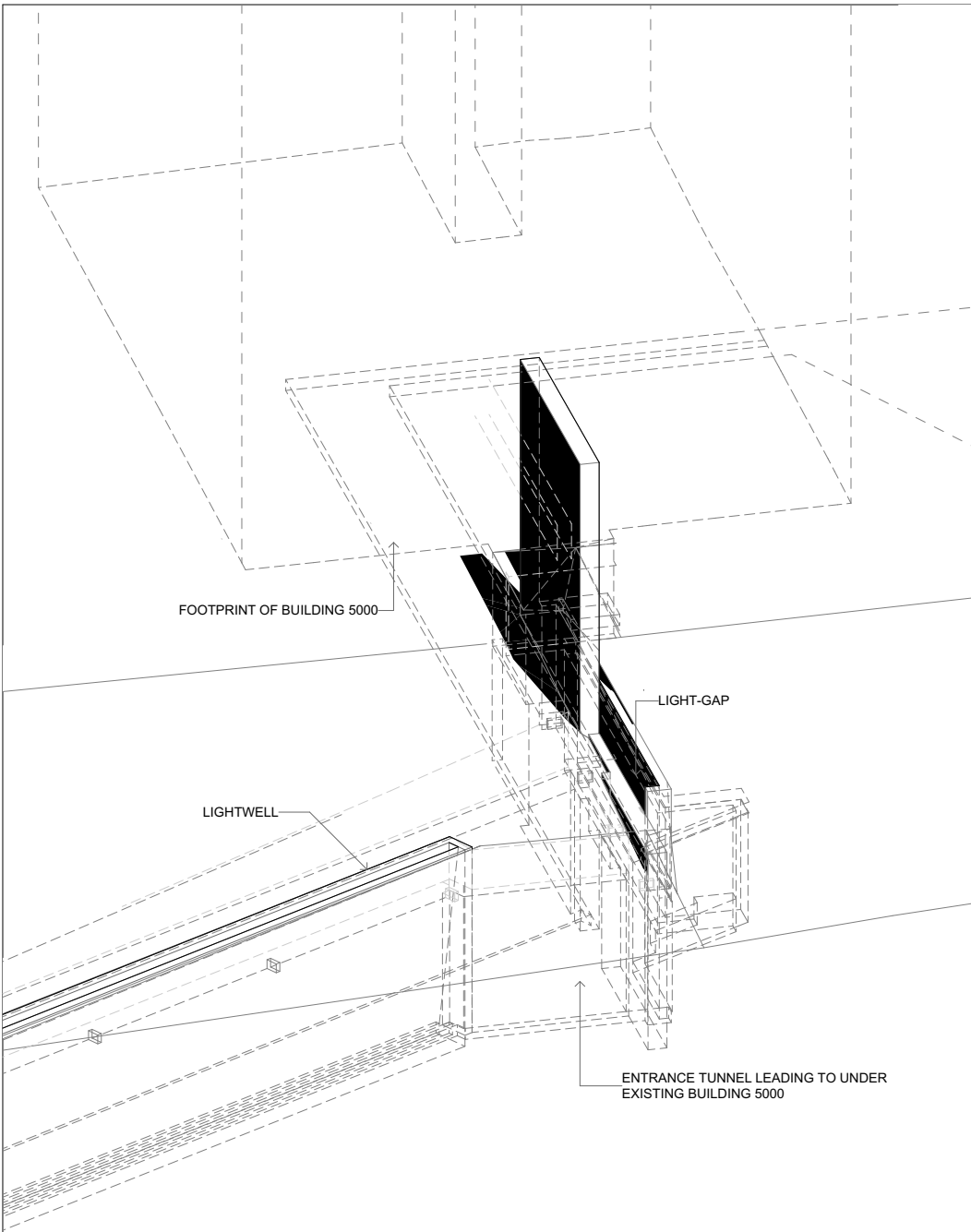


BELOW GROUND FLOOR PLAN

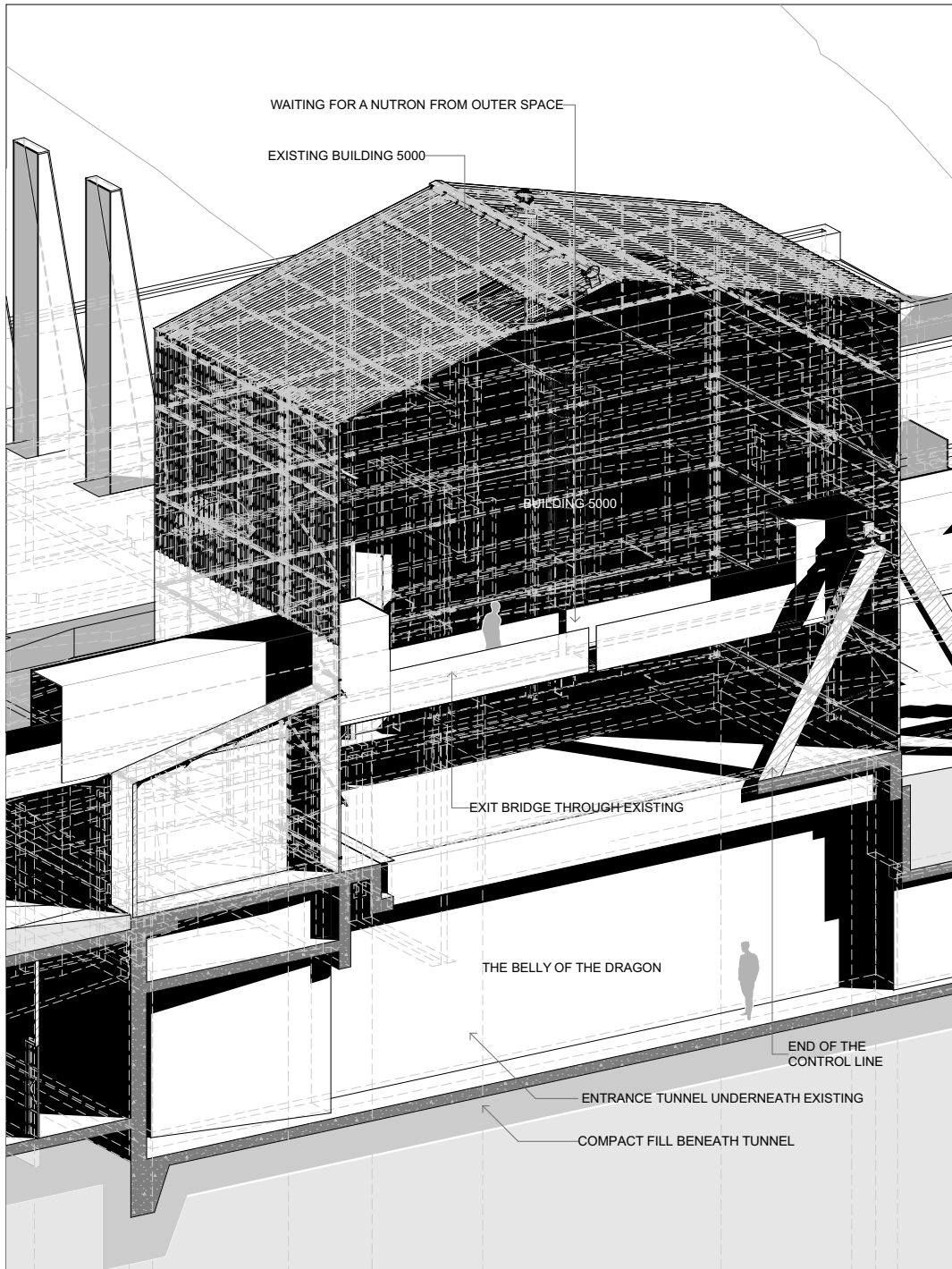
SCALE 1:200



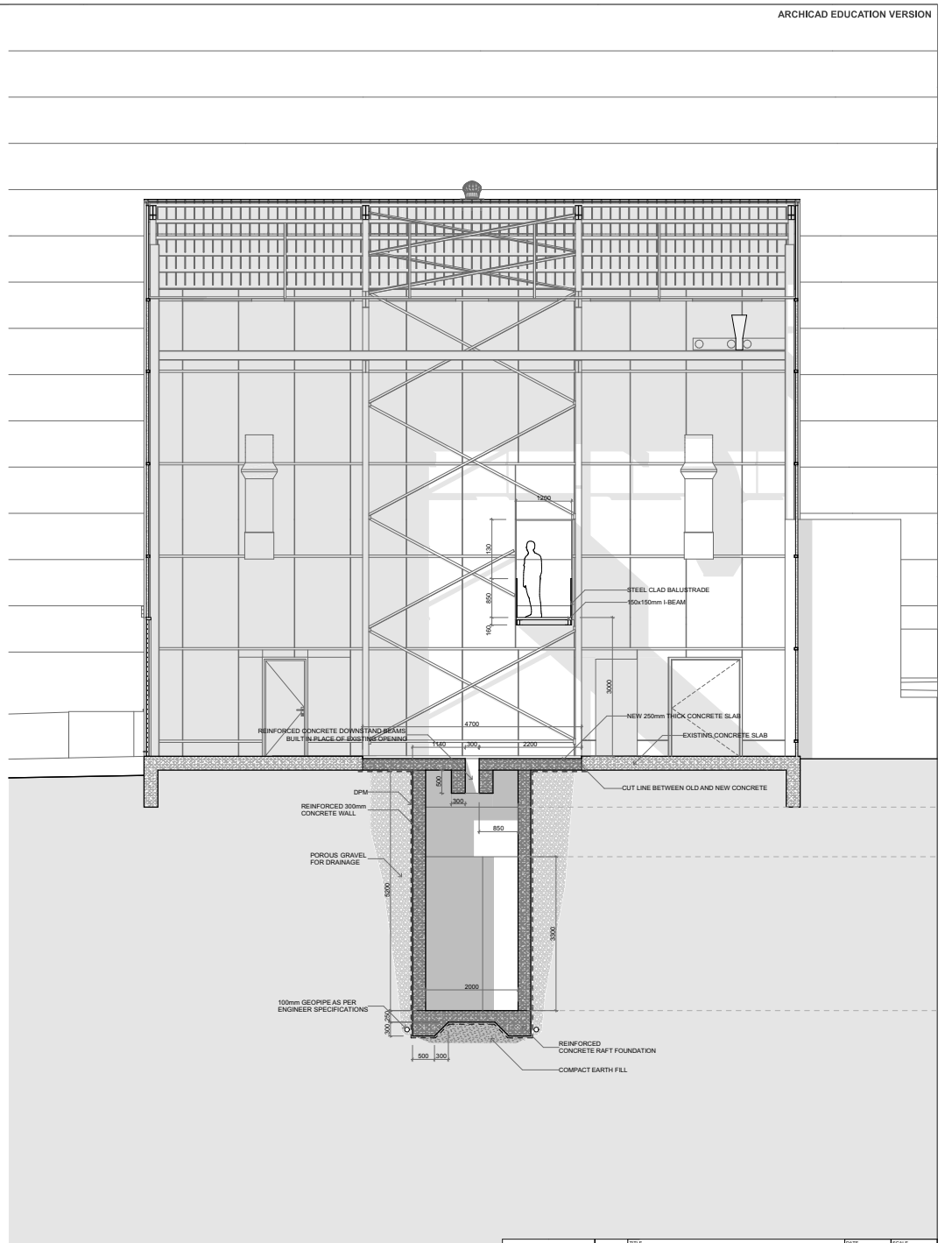
WOOD CONTACT: ARIAN WOOD arian@woodgroup.com WWW.WOODGROUP.COM	TITLE: MAIN NEW SET AT 5000 SHEET: BELOW GROUND FLOOR PLAN	DATE: 15/11/2023 DRAWN BY: A.WOOD	SCALE: 1:200 CDS: A1
	DESIGNER: (Empty) CHECKED: (Empty)	DATE: (Empty) DRAWN: (Empty)	PAGE: 25
	REV: FINAL DOCUMENTATION	DATE: (Empty)	DRAWN BY: (Empty)
	(Empty)	(Empty)	(Empty)



WOOD		TITLE: MAIN NEW SET AT 5000		DATE: 10/11/2023	SCALE: 1:50
CONTACT: ARIAN WOOD arianwood@gmail.com		SHEET: SECTION AND ISOMETRIC		DRAWN BY: A. WOOD	SIZE: A1
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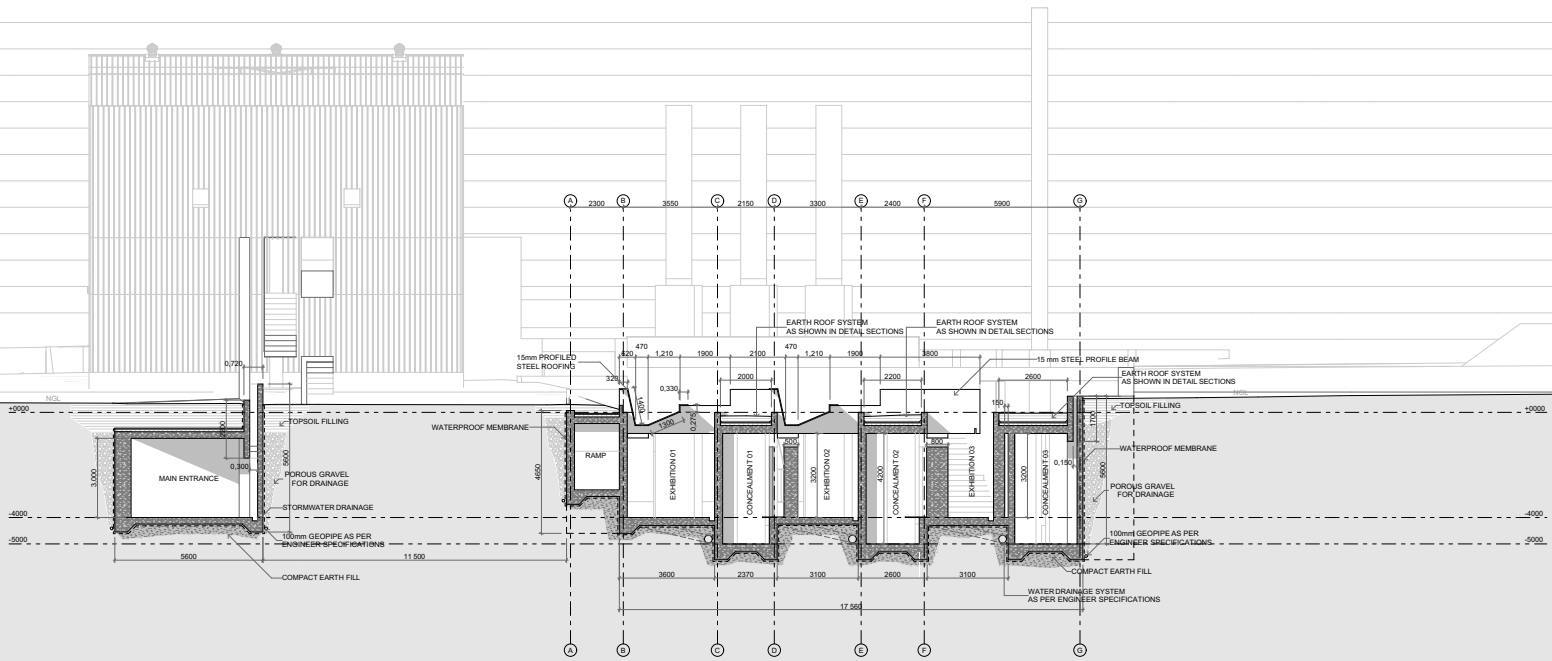


ISOMETRIC SECTION H-H
SCALE 1:50

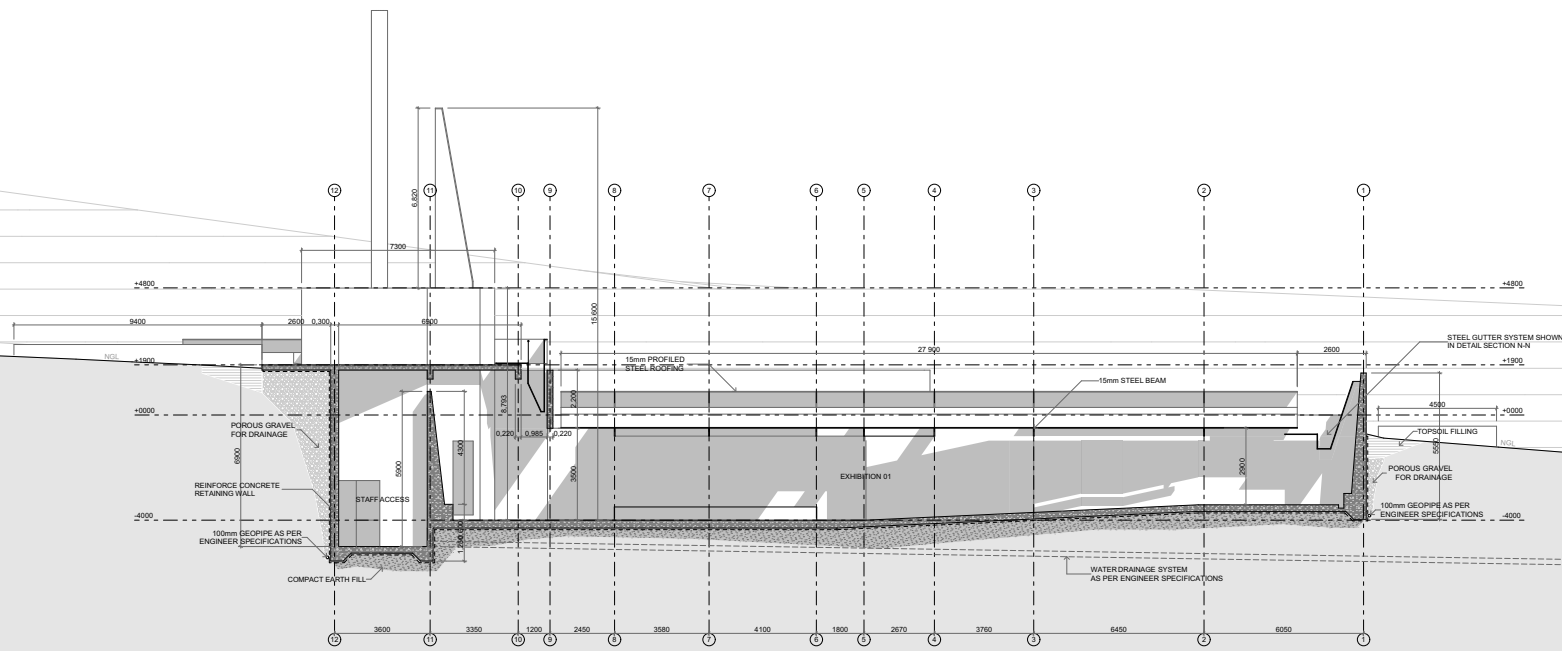


SECTION I-I
SCALE 1:50

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	<p>DESIGNER: A.W.</p> <p>PROJECT: SECTION AND ISOMETRIC SECTION</p> <p>DESCRIPTION: Designing secondary stage of addition structure at Building 5000.</p>
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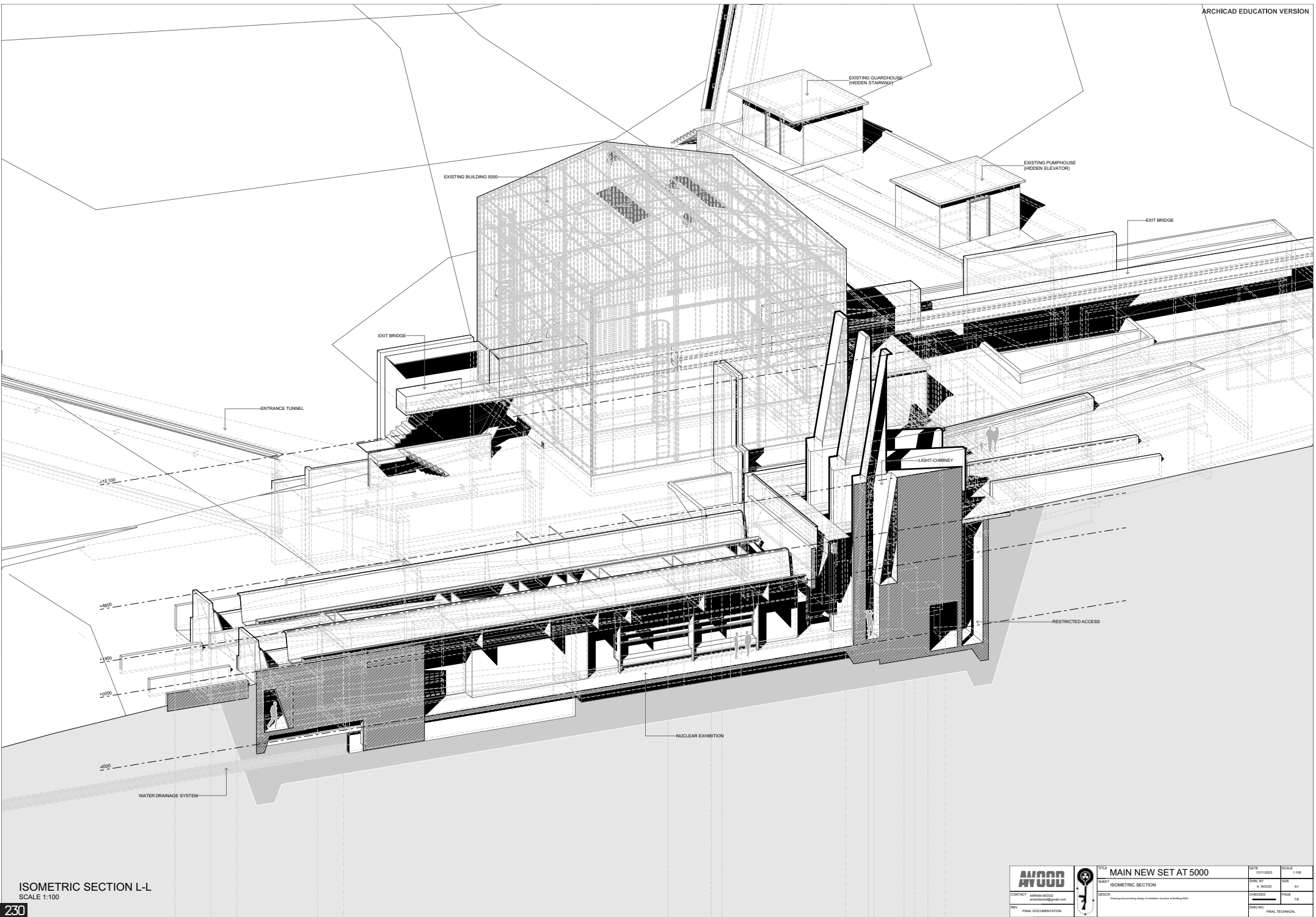


SECTION J-J
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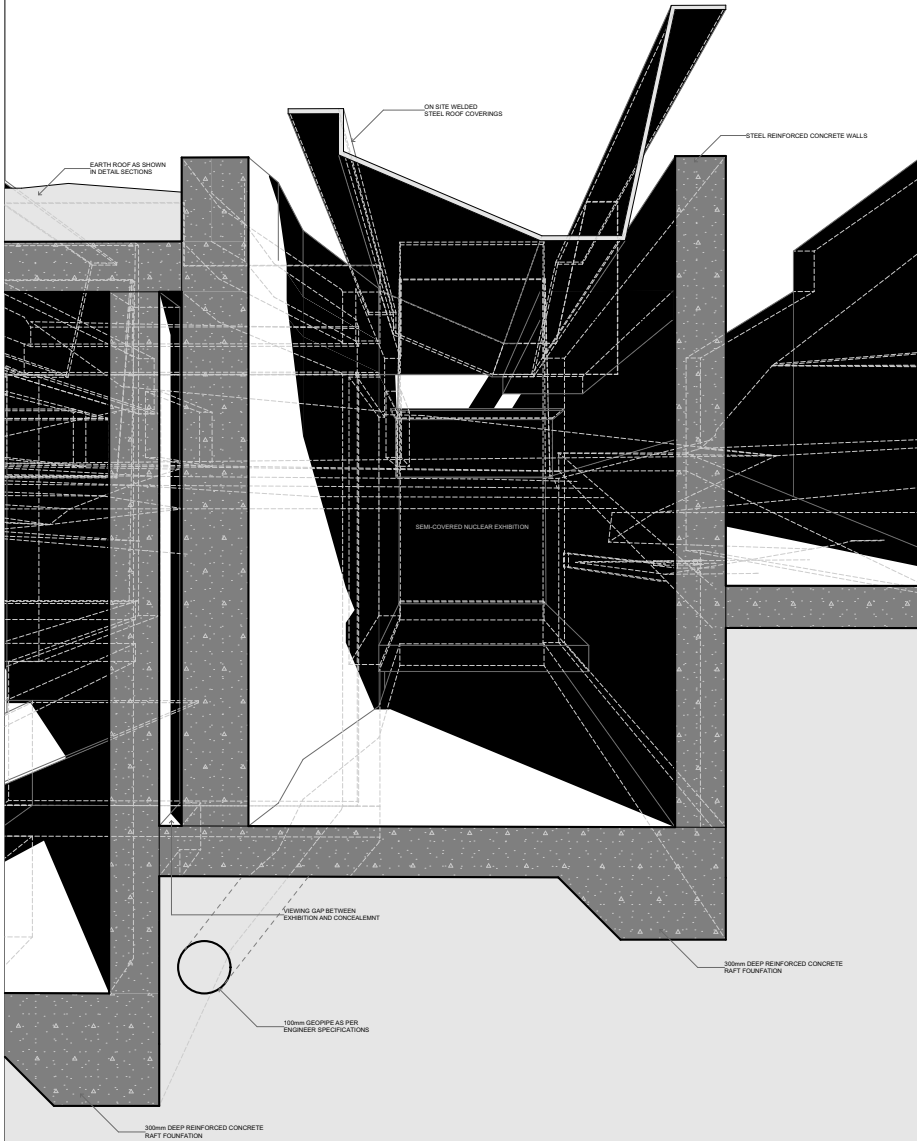
SECTION K-K
SCALE 1:100

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	<p>229</p>	
	<p>ARCHICAD EDUCATION VERSION</p>	
	<p>Copyright Reserved by Archicad Education at Bentley Systems, Inc.</p>	

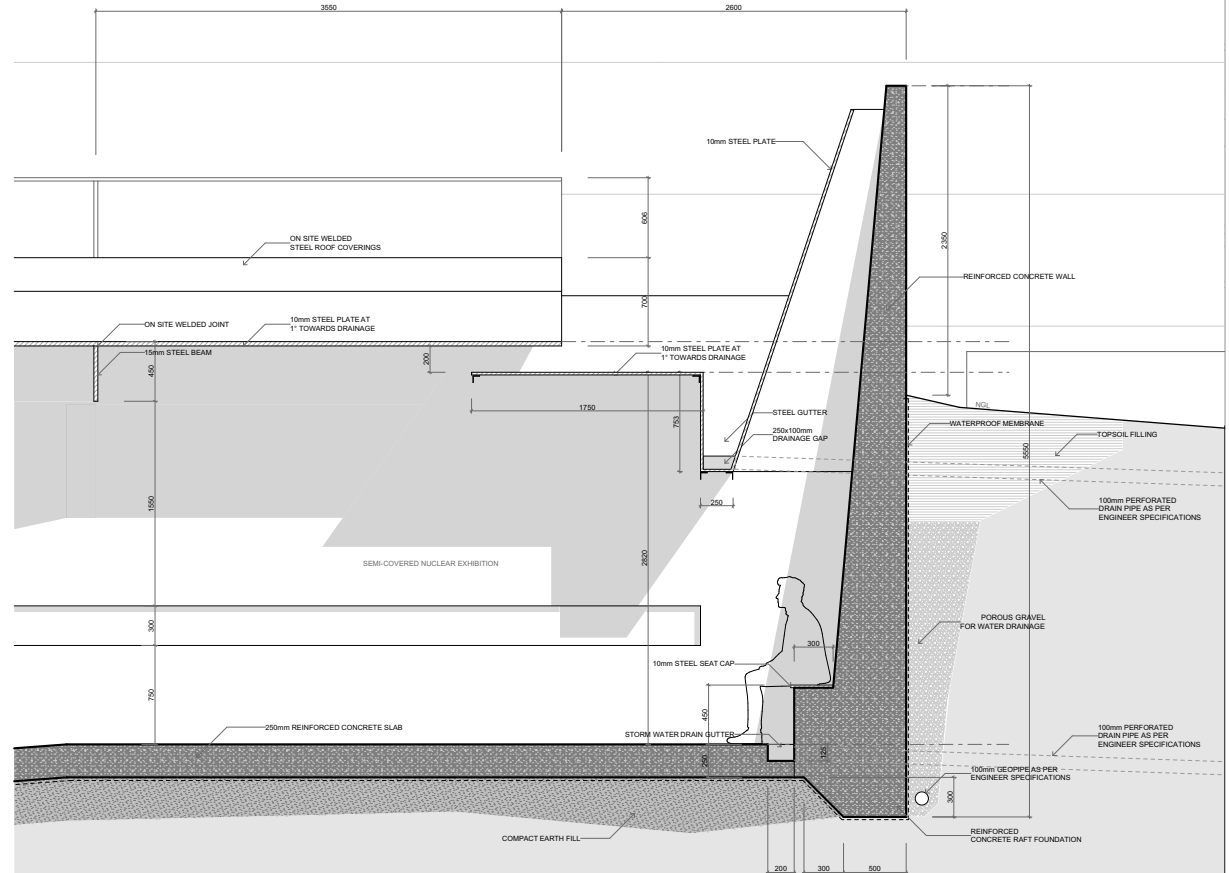


ISOMETRIC SECTION L-L
SCALE 1:100

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	DESIGNED BY		CHECKED		PAGE	78
	REV.	FINAL DOCUMENTATION	DRWG. NO.	FINAL TECHNICAL		



TWO-POINT PERSPECTIVE SECTION M-M
NOT TO SCALE

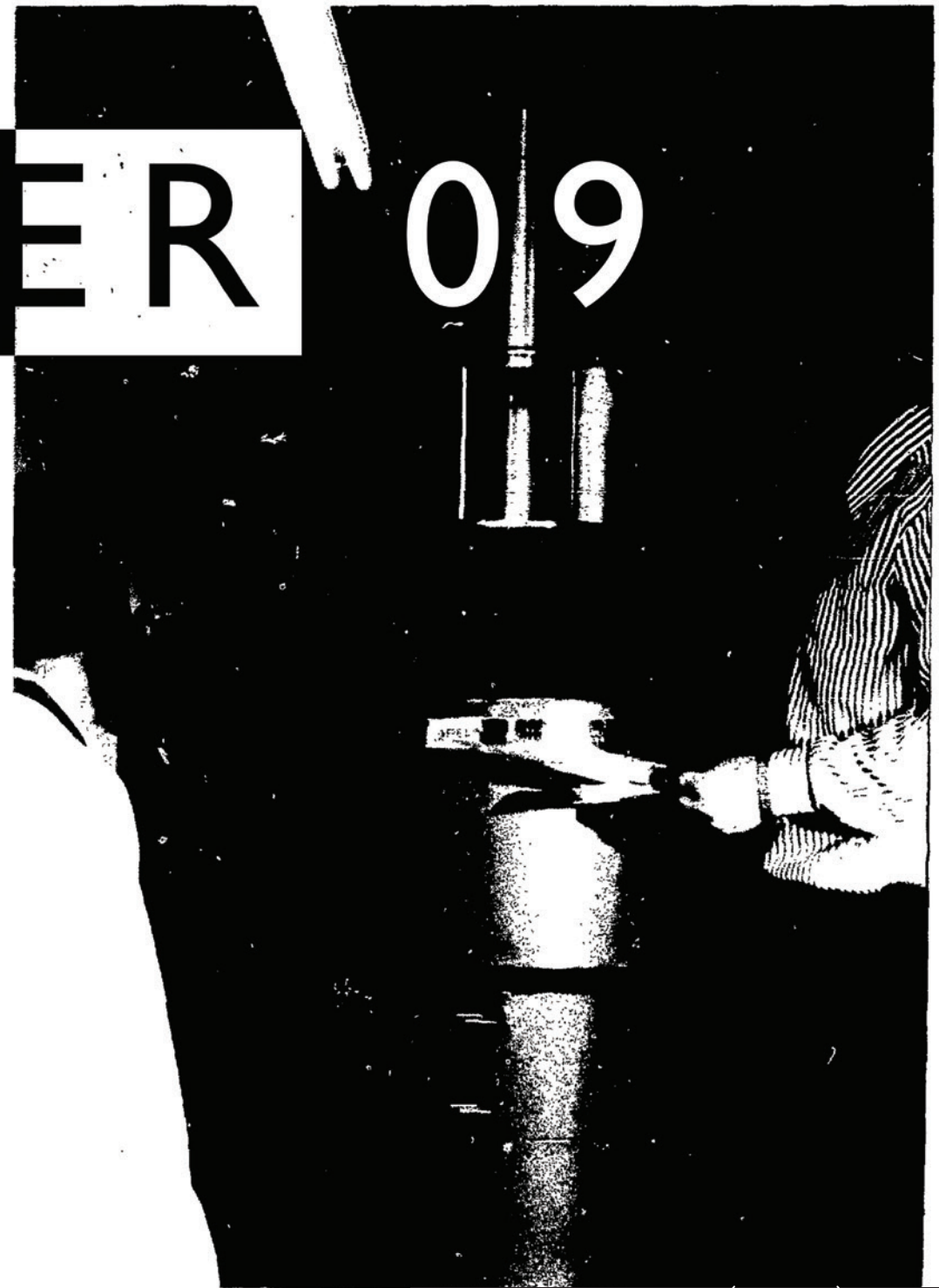


DETAIL SECTION N-N
SCALE 1:20

<p>CONTACT: ARIAN WOOD ariandwood@gmail.com</p> <p>REV: FINAL DOCUMENTATION</p>	<p>TITLE: MAIN NEW SET AT 5000</p> <p>SHEET: DETAIL SECTION</p> <p>DESIGN: [Signature]</p>	<p>DATE: 13/11/2023</p> <p>CON. BY: A.WOOD</p> <p>DRAWN BY: [Signature]</p>	<p>SCALE: 1:20</p> <p>SHEET: 41</p> <p>PAGE: 41</p> <p>STATUS: FINAL TECHNIQUE</p>
	<p>231</p>		
	<p>DRINKING WATER SUPPLY DESIGN OF BUILDING STRUCTURE AT BENTLEY 5000</p>		
	<p>ARCHITECT: ARIAN WOOD ARCHITECTS</p>		

CHAPTER 09

CONCLUSION



9.1 TYING LOOSE ENDS

The Border War's legacy is one of lingering gunfire in hearts and battles still fought on paper. Similarly, the nuclear program, shrouded in secrecy, has left a lasting but silent legacy. The research here explored the elusive space between memory and memorialization, acknowledging the haunting spectres of the past. The remembrances of the nuclear site must embrace its historical context, scarred by battle lines. The nuclear remains are an enduring anchor, inviting confessions to withstand fading memories, a shared history shaped by individual interpretations.

The research question can now in conclusion perhaps not be definitively answered but at least addressed with substantial evidence:

How can a spectral architecture mould a place of inverted memorialisation out of the core witnessing experiences of those discarded machined souls and soulless machines entangled in the obscurantist mindset that birthed the nuclear weapons program at Pelindaba in the context of the Border War?

The poetics of architecture can begin to provide a form striving much more for the mould than the cast. If the inverted monument as a concept can represent permeable interpretation, the inhabitant may form a new revelation in their mind of what the inverted monument truly is. The statue is a pre-formed idea of representation waiting to be beholden, while the mould awaits the molten to be cast into it.

The statue conceals all that it does not show in its direct form and everything beyond it is not found in its direct representation. It is concealment through omission. It does not allow for new revelation. These 'land-anchored' objects are too anchored in their memory. The inverted monument does not try to conceal itself through omission but rather through its hiddenness. Where the statue represents one perspective, and one only, the inverted monument allows for further representation beyond its form. It means allowing memory to be sufficiently ambiguous and open so that others may inhabit the space and imbue that form with their own memory.

The research question attempts to bring this idea of allowing the reference to the built form of memory (the statue) to remain partially hidden so that it becomes ever-telling in its always new interpretation. The rest of the research question is meant to guide the research in the document and provide supporting guidelines for the establishment of how to tackle the theme of this document to create an architectural outcome.

The 'obscurantist mindset' of the history of the nuclear weapons program persists to this day. What remains is largely undisclosed to current memory and out of the public discourse. Simultaneously, the memory of the Border War remains a sensitive topic for many and non-existent for others. South Africa does not have the fallout of brutal conflict to trigger memory of events of the past, unlike the bush landscape of Angola where mines and rusted vehicles still remain. Yet, there is still a hidden scar of the war that is in the minds of all those who had to endure it.

The corporeal engagement with memory comes in the form of the built environment. Architecture is able to reach things that words find difficult to describe, and the hiddenness of place can be reached by architecture that engages with it.

In the end, built forms of memory today largely remain in answer to their separate constituencies, each reflecting a different meaning in their remembrance. The monuments and memorial grounds constructed in South Africa differ in their remembrance from those in Namibia and Angola. Even within South African borders, lines are drawn between memorial spaces to separate the memory of them. The most ideal vision of the inverted monument is that different groups of people may come to recall the past in the light of another's historical memory, each coming to know more about the other's witnessing in the light of shared remembrance.



Figure 276: Sheet metal walls of obscurantism (author, 2023).

9.2 REFLECTON

This thesis tackled some very challenging topics involved with controversial politics and a wealth of information that has been incredibly difficult to access. Due to this, much of the time spent this year was in trying to obtain information relating to the research for this thesis. Many interesting collected documents, sources and other information surrounding the Pelindaba site remain undisclosed to the reader in order to keep this document concise.

The scope of this thesis was a difficult task. Choosing which research to omit and where to focus has been most challenging. Doubtless, there are so many ways to enter into the conversation surrounding built-forms of memory and memorialisation that there could have been many different interpretations of this thesis. However, what has been presented was my best attempt at dealing with the topics of architecture in conflict and nuclear weapons development. The architectural character took a long time to reveal itself as well.

Certain elements of site analysis were clear from initial work, such as which existing buildings to engage with on the site, working along the control line and the intervention of underground structures. But exactly what that looked like was never fully clear, which was poetic in a sense. The design concealed itself for much of the year and has been difficult for outsiders to understand, almost as if I was censoring structure from those individuals.

One of the biggest breakthroughs of this thesis was gaining access to the site. I had been trying to organise a visit since the year before with no success and almost gave up on using it. Only through walking in faith did I meet the person who was able to give me an unplanned tour of all of the buildings at an unprecedented level. This disclosure changed the course of this thesis and made contributing something to the historical record of these buildings a reality. I am incredibly appreciative of the opportunity to not only release some of the only photos seen of the site since 2002, but to be able to document the structures of the remaining Buildings 5100 and 5000. This has also gained the interest of the Institute for Science and International Security and hopefully, a co-authored report will be released including my research on the current state of the site in the next few months after this thesis has been completed.

The Way Forward:

The stage of design reached in this document is not the end of the progress of the design. I was not able to reach the desired level of design representation and explanation that I wished to have accomplished. However, I do believe that the reader will be able to explore the intended contextual analysis and theoretical work integrated with conceptual design. Not all standards of design conventions may have been met, but I do believe one would be able to understand the intended design.

Even without completing the representation to my own standard, I have thoroughly enjoyed the last year or so of work on this thesis. I find the topics I have researched to be especially interesting as well as delving into history that is intimately involved in our county's past. I am grateful for the opportunity to explore this design and enter this work into the conversations around memory.

To me, design is the feeling I am able to portray through graphic and textual communication. It is an exciting dialogue, one that I will never give up.

THE SITE



Figure 277: Walking over the hills in Pelindaba with the nuclear site in the distance (author's wife, 2023).

LIST OF TERMS

- AEB – Atomic Energy Board, later rebranded as NECSA
- Armscor – Armaments Corporation of South Africa
- FN FAL – Fabrique Nationale Fusil Automatique Leger
- FNLA – National Liberation Front of Angola
- HEU – Highly Enriched Uranium
- IAEA – International Atomic Energy Agency
- ISIS – Institute for Science and International Security
- MPLA - People’s Movement for the Liberation of Angola
- NECSA – Nuclear Energy Corporation of South Africa
- NPT – Nuclear Non-Proliferation Treaty
- PNE – Peaceful Nuclear Explosive
- RSA – Republic of South Africa
- SADF – South African Defence Force
- SAFARI-1 – Light water-cooled research reactor at Pelindaba
- SWA – South West Africa
- SWAPO – South-West Africa People’s Organization
- UN – United Nations
- UNITA – National Union for the Total Independence of Angola
- US – United States
- USSR – Union of Soviet Socialist Republics

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CHAPTER 10

AFTER THE END

FUNDAMENTAL STUDIES

A number of AEB scientists are engaged in research projects of a fundamental nature. Some of these projects are briefly described below.

NUCLEAR PHYSICS

10.1 FADING MEMORY

In the end, only spectres remain. The resolution of the nuclear bomb is final. The architecture of conflict remains as the rubble left behind. These are the scars of warfare, leaving the markers of physical remembrance to haunt the corners of place.

Further, as those who are left as flesh-witnesses fade, memory of their personal experience fades and, in time, the memory of these events fades. Just as they do, the site fades into the realm of obscurantist recollection.

The following is a visual exploration of the design faded with memory and a terrible reminder of the architecture of conflict...





Figure 279: The site after the end (author, 2023).



Figure 280: Faded facades of Building 5100 (author, 2023).



Figure 281: Walls of 5100 (author, 2023).



Figure 282: Inside the foundry long after the last cast (author, 2023).



Figure 283: Following the landscape when nothing else remains (author, 2023).



Figure 284: What remains of the trench (author, 2023).



Figure 285: Fading references of remembrance, the inverted monument (author, 2023).





Figure 287: The last trench that was ever needed (author, 2023).



Figure 288: The remains of Building 5000 and barren landscape (author, 2023).

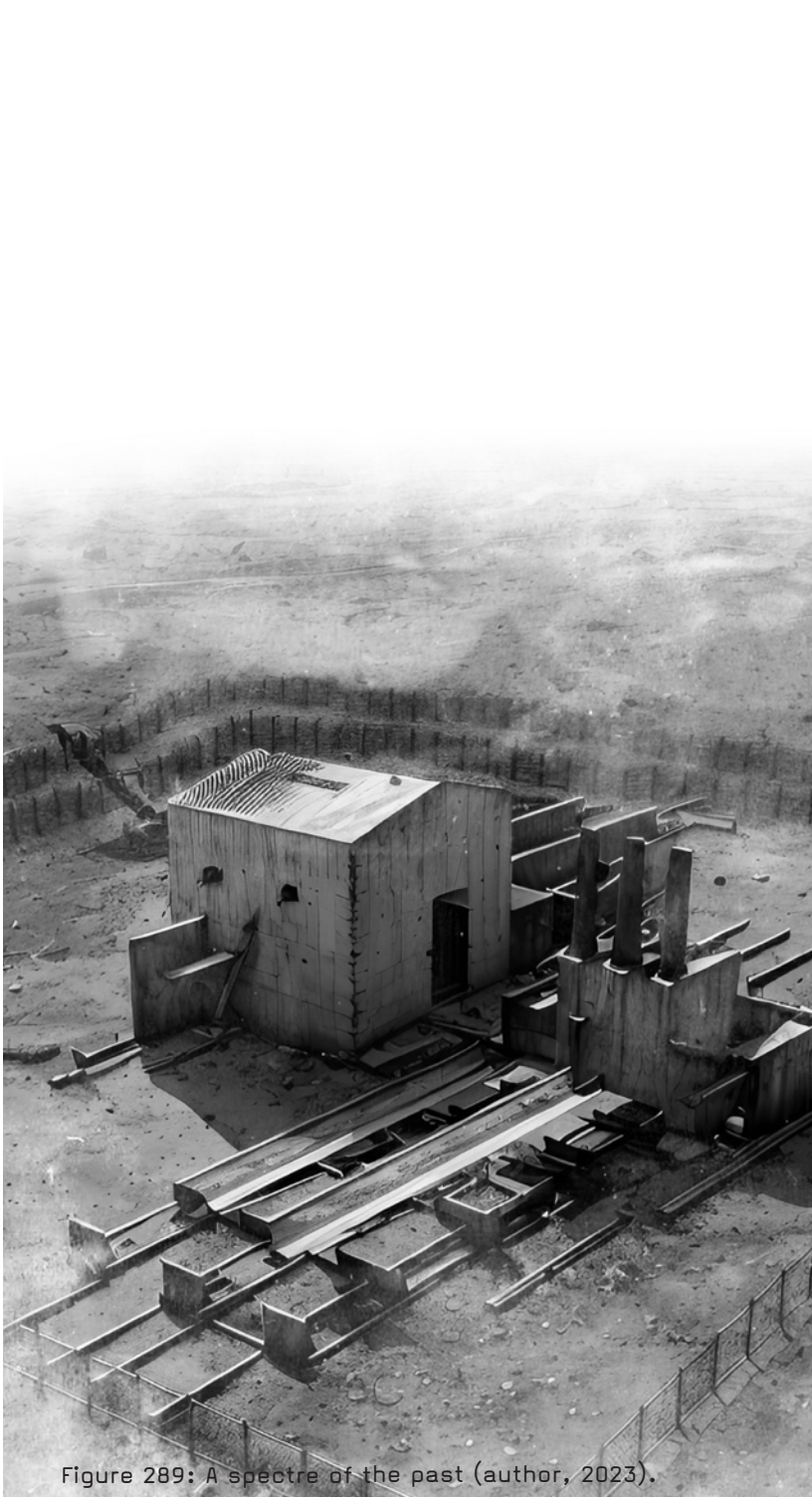


Figure 289: A spectre of the past (author, 2023).



Figure 290: Tectonics of the end (author, 2023).



Figure 291: Last forms outside 5000 (author, 2023).



Figure 292: Empty corridors of the last exhibition (author, 2023).



Figure 293: Devastated structure of once welcoming design (author, 2023).

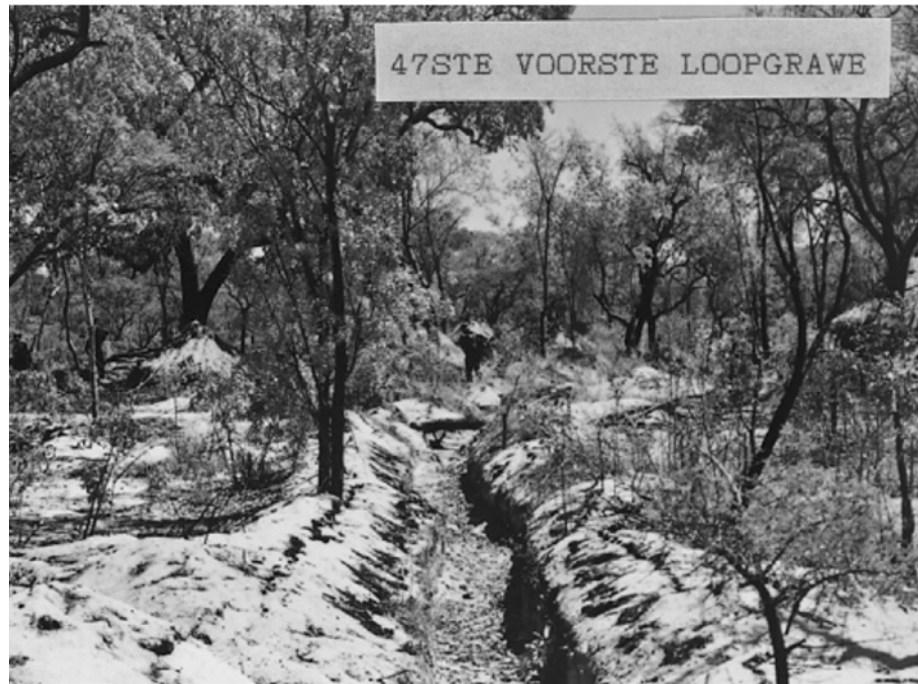


Figure 294: An architecture of conflict of the Border War, the trench (Venter, 2019).