MANIFESTING THE MEMORY

A MEMORIAL FOR A METEORITE

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To God, the architect of my life, for the inspiration, ability and guidance through everything I do. My family and friends, for the loyal support, love and understanding. Prof Piet Vosloo and Jacques Laubscher, for the support, guidance and inspiration throughout the year. The Class of 2009 for great times in the midst of all the hard work.

ABSTRACT

Keywords: memory, experience, light, heritage, industrial ruins, meteorite impact crater, memorial.

Architecture extends far beyond the structuring of basic shelter. The role of architecture is to have a positive contribution on the human being and the surrounding environment.

The thesis proposes to re-address the experience of architecture in the public realm and investigate its responsibility and potential contribution towards cultural and environmental heritage.

The selected project is an Interpretation centre for the Tswaing Meteorite Crater, located within the historic salt and soda factory in the Tswaing Nature reserve, Gauteng, South Africa.

Argitektuur beslaan oor meer as net die voldoening aan die primêre behoefte vir beskutting. Die rol van argitektuur is om 'n positiewe en invloedryke omgewing te skep vir die verbruiker en die omliggende gemeenskap.

Die doel van hierdie verhandeling is om die ervaring van argitektuur in die publieke milieu en die bydrae daarvan tot die kulturele en omgewingserfenis te ondersoek.

Die uitgekose projek is 'n interpretasie sentrum vir die Tswaing Meteoriet Impak Krater, geleë in die historiese sout en soda fabriek in die Tswaing Natuurreservaat, Gauteng, Suid-Afrika.

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01 PROJECT BRIEF

The brief reflects a response to the Tswaing Meteorite Crater [TMC], with the proposal of an architectural intervention responding to the identified needs and potential of the site.

1.1 The site

The Tswaing impact crater was created by a meteorite crashing into the earth's crust approximately 220 000 years ago.

Tswaing, meaning the Place of Salt in Setswana, is a 2000 hectare conservation area in South Africa. It is located in Tshwane, 40km northwest of the Pretoria CBD, and borders the Winterveld and Soshanguve settlements. It is one of the best-preserved impact craters in the world and the only crater that is accessible by foot right down to its centre. It is therefore a very sensitive and unique conservation area with a variety of ecosystems, a wetland, and the remains of a factory that in the past produced soda ash and salt. [Reimold, Brandt, De Jongh & Hancox, 1999:1]

Figure 1.02 Location map of the Tswaing Meteor impact Crater [TMC]

Figure 1.01 Aerial view of the TMC [Adapted from the image accessed on [http://rst.gsfc.nasa.gov/Sect18/Sect18_6.html accessed 24.02.2009]

1.2 Problem setting

Architecture

Architecture is the art of creating places where human beings can dwell on earth beneath the sky [Norberg-Schulz, 1985:23]. Architecture becomes the stage upon which the story of each individual is acted out. It is therefore of fundamental importance to comprehend the influence that architecture as an environment has on the user.

Technology as a threat to public spaces

With the rapid advancement of technologies such as the Internet, the need to interact with people and places to obtain information is decreasing dramatically. Consequently, the question is raised as to what architecture's responsibility towards the sustainability and livelihood of public spaces – such as memorials and museums – will be in the future.

Memorial as building typology

Many past events go unmarked and unremembered, and eventually lose their significance. In modern day society, memorials are constructed 'serving to preserve the memory of the dead or a past event; serving as a remembrance' [Anderson,2007]. Contemporary memorials seem to focus on capturing and freezing memory, rarely informing the visitor of the historic context or its present and future relevance. According to Kieran Long [2007:75], 'minimalism has become the accepted, culturally sensitive way of commemorating loss. But does it communicate anything more than silence?'

Selected site

South Africa's natural and cultural heritage resources are continually being threatened as a result of unsustainable development, urban encroachment, and a lack of urgency to protect habitats, species, heritage sites and values [Bewsher, 2005:2].

The Tswaing meteor crater [TMC] represents a conservation area of irreplaceable value. The site is currently in desperate need of an informative intervention that would enable various users and management systems to protect the heritage and significance of the site for present and future generations. Limited sources are available regarding the history of the site, and the related oral traditions are rapidly fading.

1.3 Aims and objectives

The aims and objectives of the proposal are as follows:

To investigate the potential integration of the intangible dimension [of meaning, memory, atmosphere and lived experience] into the tangible component [landscape and architecture] by exploring the nature of the memorial and museum in contemporary society, and evaluating its success and possible future in the African context with the integration of environmental, social and economic sustainability.

1.4 Points of departure

The points of departure are as follows:

An exploration leading to the investigation of how architecture is experienced; the effect, subconsciously and consciously, that architecture can and should have on the everyday user in enhancing perceptual experience by means of sensory stimulation.

To investigate the potential of architectural elements to transform the imagination and reach into the visitor's memory while creating an awareness regarding the perceptual consciousness of the surrounding environment.

To commemorate an event that is significant in the history and topography of the northern Tshwane region by means of architecture that is accessible to the general public.

To investigate the potential of re-utilising existing structures to retain both the physical and metaphysical memory related to the site by means of an analysis based on the principles in the Burra Charter.

1.5 Design objectives

The design objectives of the proposal are as follows:

To manifest the memory of the site and its related histories by integrating the intangible aspects such as memory, and implementing architectural interventions that become devices for perceiving and experiencing the memory of the site. This would be achieved by simultaneously facilitating the consciousness of the body and the imagination, and enabling the memory to stay alive and continue expanding into the future without detracting from the unique natural character and setting that the project is located in.

To re-address the typology of the memorial in the African context for the present and future by facilitating sustainable management, conservation and development.

To provide a means of facilitating education, awareness and enjoyment of one of the country's prime geological heritage sites and consequently ensure that the fragile environment be protected against damage and destruction and therefore be preserved in its entirety.

To investigate the potential of the architectural intervention to act as facilitator and income generator for the site and the immediate community.

To ensure minimal impact on the natural environment by minimising the potential ecological footprint caused by the construction by integrating sustainable design and construction, integrating inclusive design principles, considering the use of materials, natural heating, cooling, lighting and other methods, as well as utilising the local workforce.

1.6 Methodology

The proposed research methodology to be followed is the descriptive survey method, where the site and surrounding environment will be analysed by means of physically experiencing the site at different times and by conducting interviews with relevant interested parties. The aim is to observe and translate the information gathered into a fully developed design.

The system approach illustrated in figure 01:03 will be used as part of the research and design development strategy.

The design methodology will proceed to:

- **Unveil the site's memories**
- **Identify the functions/activities to take place**
- **Analyse the experiences relating to humans**
- **Translate these into architectural form**

1.7 Client profile

The registered landowner of the site is the National Department of Public Works. It is managed by the Northern Flagship Institution, a heritage conservation institute which comprises the national museums in Gauteng, and which was established in terms of the 1998 Cultural Institutions Act [Act 119 of 1998].

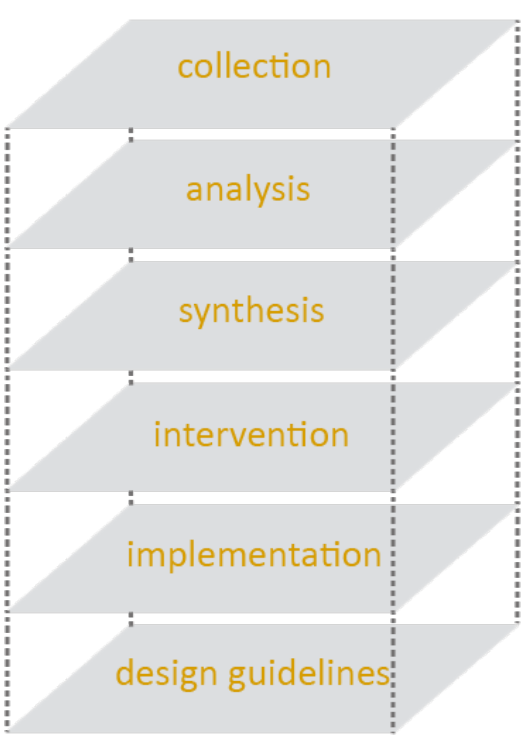


Figure 1.04 Proposed research methodology

1.8 User profile

The user profile consists of a day visitors that come to view the crater, staff members that are employed at the TMC of which some of them might stay on site, researchers that do research at the TMC regarding fields such as geology and archeology, members of the community who visit the site for spiritual rituals and beliefs, learners who visit the site to learn more about the various aspects involved with the site and its history and the immediate surrounding community from the Soutpan and Soshanguve settlements who might benefit from the development in terms of economic empowerment, creating entrepreneurial initiatives as well as education in various related fields.

Figure 1.05 Identified user groups and associated requirements

02 CONTEXT ANALYSIS

The purpose of the Context Analysis is to provide a general understanding of the greater context within which the design intervention is proposed.

The background, climatic conditions, significance, vegetation and historical context is discussed to enable a greater insight and comprehension pertaining to the various design decisions that were taken.

2.1 Background

220 000 years ago a blazing meteorite crashed into the earth's crust. The collision resulted in an impact crater with a diameter of 1,13km and a depth of 200m. This crater is currently known as the Tswaing Crater, previously famous as the Pretoria Saltpan or Zoutpan crater [Reimold et al, 1999:1].

The site has strong associations with storytelling and mythological beliefs sparked by the significant magical realm presented by this unique and nearly perfectly circular structure. Some storytellers profess that a giant snake lives just below the gloomy waters of the crater lake and that this creature trains sangomas [traditional healers and prophets] in their skills [Reimold et al, 1999:1].

For many years scientists have struggled to determine the origin of this unique structure. It was much debated whether it was created by a volcanic eruption or a meteorite impact. After extensive testing and sampling by means of a drill core through the interior of the crater in the 1990's, it became clear, and is today accepted, that the crater originated by means of a violent explosion that was triggered by the hypervelocity impact of a large meteorite approximately 220 000 years ago [Reimold et al, 1999:1].

It is one of the best preserved impact craters in the world and the only crater that is accessible by foot right down to its centre. It is the fourth meteorite crater museum in the world, and the only one in Africa [others being the Meteor Crater in the United States, Ries Crater in Germany, and some exhibits in the town of Rochechouart in France] [Reimold et al, 1999:2].

Memorandums of Understanding have been concluded between the NFI [National Flagship Institute] and the City of Tshwane, and the NFI and GDACE [Gauteng Department of Agriculture, Conservation and Environment] in an attempt to ensure the effective management and development of Tswaing. Informal relationships exist between the NFI and the Council for Geoscience, the University of the Witwatersrand, the Scouting Association of South Africa, the Traditional Healers Association and various other community-based organisations [Bewsher, 2005:7].

Figure 2.01 Aerial photograph of the TMC [http://rst.gsfc.nasa.gov/Sect18/Sect18_6.html accessed 24.02.2009]

2.2 Meteoric impact craters

Meteorites are 'rocks from heaven' - the only samples available to us for direct study of the solid matter 'out there in space', besides a few kilograms of lunar rocks returned from the moon by astronauts and space probes, and tiny cosmic dust particles collected on high flying aircraft and spacecraft.

In recent years it has also been shown that Earth has 'collected' a few meteorites that originated from Mars. Today there are thousands of meteorites in museums, private collections, and research institutions throughout the world.
[www.saao.co.za accessed on 24.02.2009].

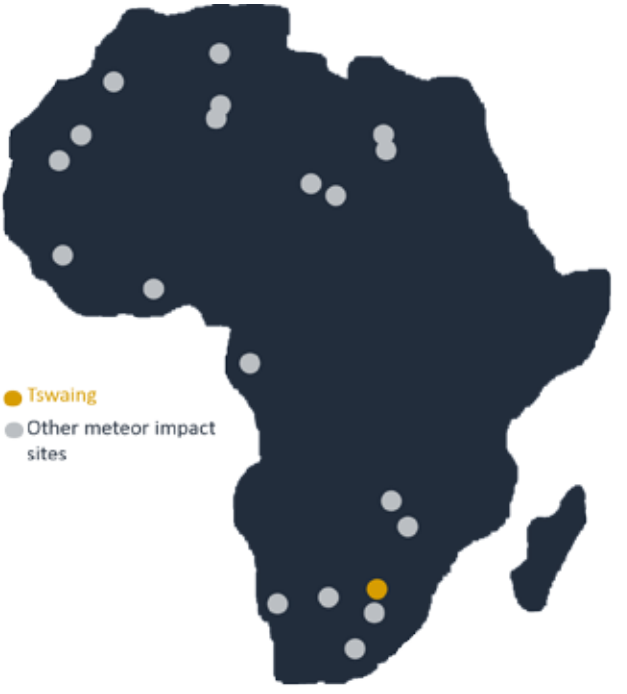


Figure 2.03 Meteor impact sites on the African continent [adapted from www.saao.co.za accessed 24.02.2009]

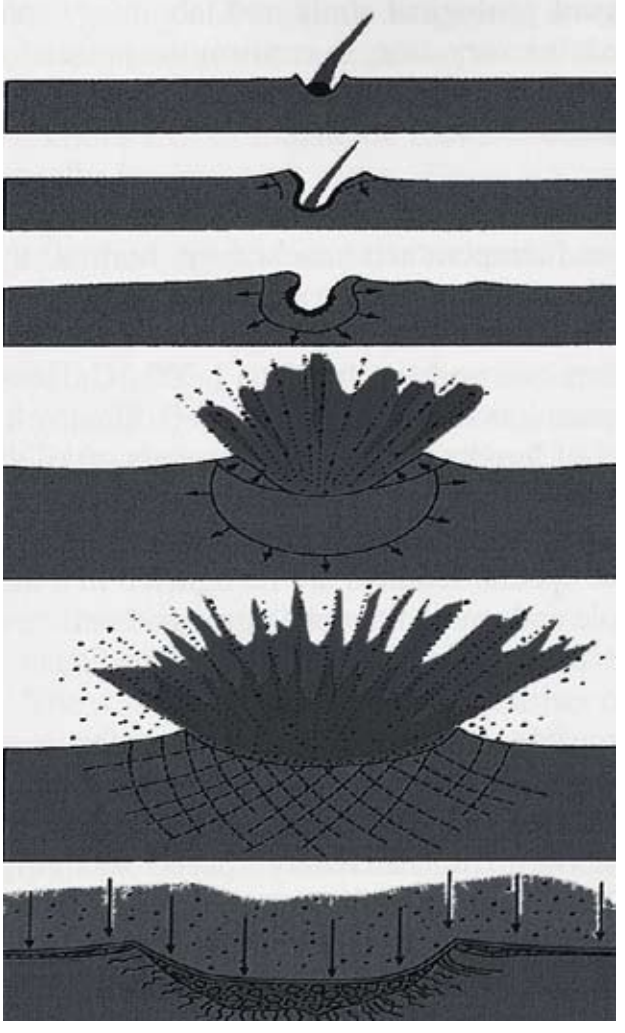


Figure 2.02 Schematic representation of the sequence of events during the formation of an impact crater. [Reimold, 1999:29]

The kinetic energy of the meteorite on reaching the Earth's surface is transferred into the ground as a shock wave. The rock is compressed as the shock wave moves downwards, with the rock at and near the point of impact experiencing the greatest pressures and temperatures. At the point of impact the rock is intensely fractured, fused, and, to some part, vaporised. The shock wave is reflected back and throws out large quantities of fragmented rock, known as fragmented breccia, or rock and mineral fragments mixed with melted material - a breccia known as suevite. The breccia outside the crater is referred to as the ejecta blanket. Large amounts of breccia also fall back into the crater. The crater rim is formed simultaneously by the solid bedrock being forced upwards and outwards. The last sketch is an envisaged section through the crater shortly [several minutes] after the impact.

Figure 2.04 The visitor centre at Vredefort dome [May 2009]

2.3 Regional Context

Site Location

Figure 2.05 Location map of the TMC in relation to the African continent

Accessibility

The Mabopane Centurion Development Corridor [MCDC] is proposed to run past Tswaing.

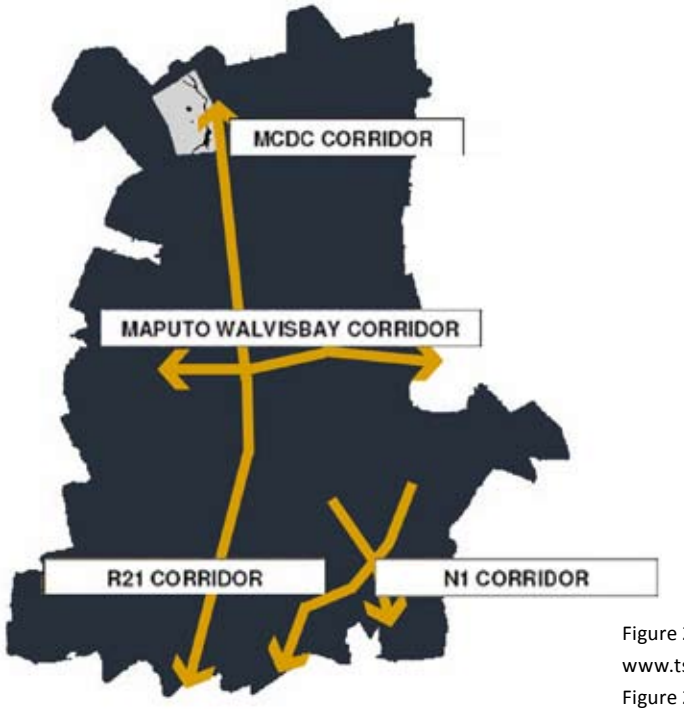
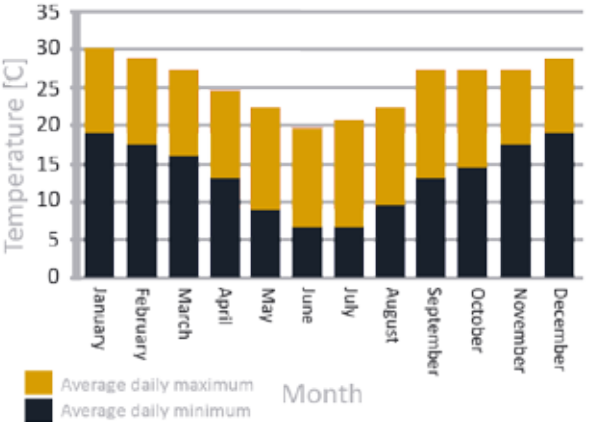
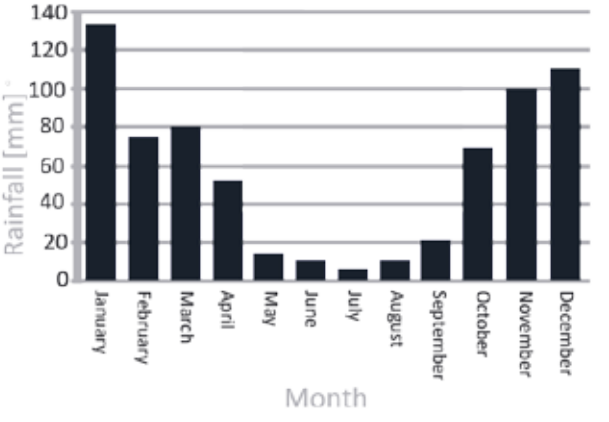


Figure 2.06 Transport and development corridors of the greater Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]





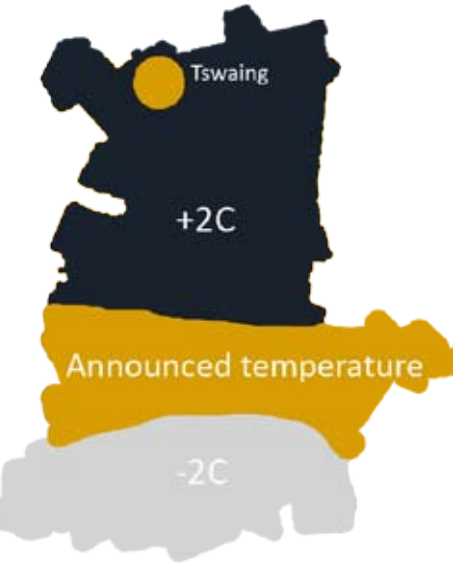


Figure 2.07 Annual precipitation graph for Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.08 Annual temperature graph for Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.09 TMC Temperature in relation to Pretoria CBD [Adapted from www.tshwane.gov.za accessed 15.03.2009]

2.4 Climate

Zoning

Because of its long-standing status as an agricultural research station Tswaing is currently protected from encroaching urbanisation. It forms a largely pristine island in a very densely populated area. This area consists primarily of informal housing and therefore lacks much in terms of educational and research facilities [Reimold et al, 1999:2].

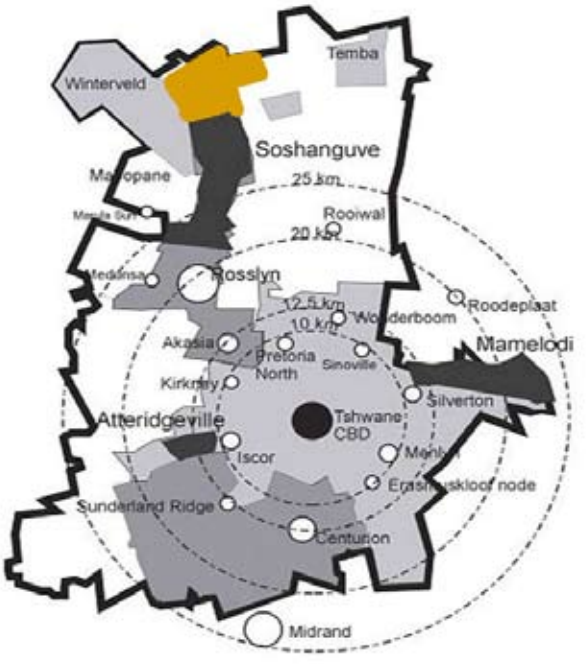


Figure 2.10 Economic development of the greater Tshwane region in relation to Pretoria CBD [Adapted from www.tshwane.gov.za accessed 15.03.2009]

The surrounding area: Soshanguve

According to Mmule, the guide from the TMC, the name Soshanguve is derived from the mixture of cultures it contains: Sotho, Shangani, Nguni and Venda. There are an estimated 1 000 000 people living in the surrounding area.

The settlement of Soutpan, located across from the existing Tswaing reception building, is part of an extension of Soshanguve. Currently no water or electricity is being provided for the Soutpan community.

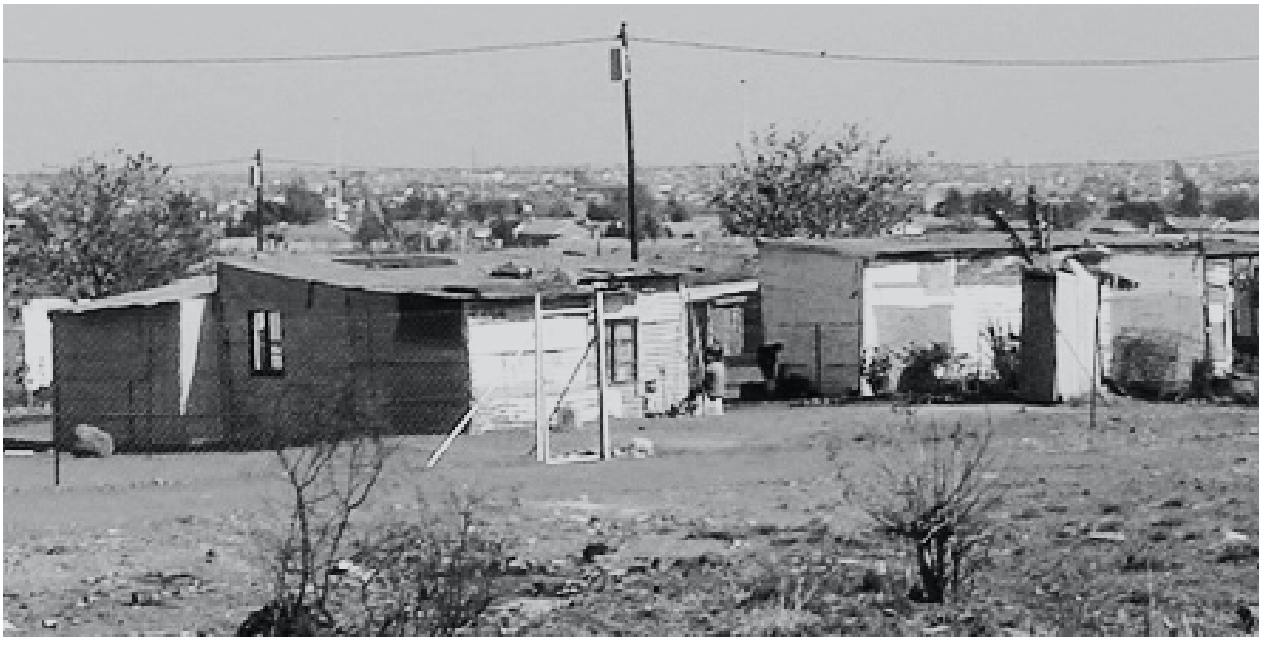


Figure 2.11 Soshanguve - informal housing [February 2009]

2.5 Context of the study area

Site significance

The TMC has a unique conservation value as a rare and extremely well preserved geological feature [Bewsher, 2005:4].

Figure 2.12 Green nodes and conservation areas within the greater Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.13 Crater lake, view towards eastern rim of crater [February 2009]

Figure 2.14 Pink Nebo Granite at TMC [February 2009]

Biodiversity

The Tswaing area is located in a Mixed Bushveld zone. Its altitude varies between 1140 and 1100 metres above sea level [Reimold et al, 1999:2]. The dominating rock type is pink Nebo Granite. The most prominent feature is the crater with its saline lake. The water of the lake is derived from groundwater and rainfall. Annual precipitation and evaporation determines the water level of the crater lake [Reimold et al, 1999:133].

The Soutpanspruit feeds an extensive wetland system that is very rare in South Africa. It is a natural habitat for a variety of animal species and hosts a unique composition of floral species [Bewsher, 2005:4].

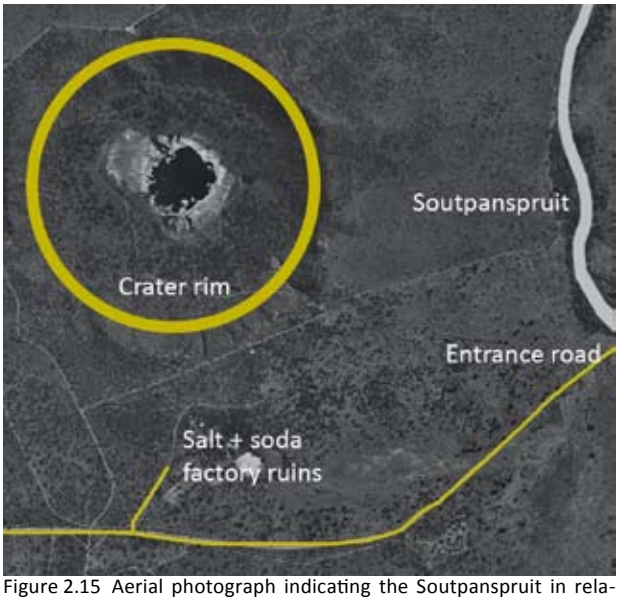


Figure 2.15 Aerial photograph indicating the Soutpanspruit in relation to the crater rim

Figure 2.16 Soutpanspruit [February 2009]

Geological significance

The large bowl-shaped feature was caused by the impact of the meteorite. The crater rim was formed when rocks and gravel were thrown outwards and deposited around the impact hole. Initially the crater rim was approximately 250m higher than it is presently. Over the years the rim weathered, causing the crater to fill with deposits of sand and gravel, resulting in a rim that is at its highest point approximately 120m from the crater floor [Reimold et al, 1999:133].

Only the Meteor Crater in Arizona surpasses the TMC in scientific, educational and tourism appeal. Tswaing is also one of the best studied and most accessible craters in the world due to the extensive tests conducted to determine the origin of the structure.

The site has been proposed as a National Monument and site museum. Tswaing is one of the country's prime geological heritage sites and is the only impact crater in Africa that is being developed to benefit environmental education, tourism and local communities [Bewsher, 2005:4-5].

The sacred nature of the site

People from the local communities come specifically for the water from the crater, as they believe that the water can spiritually cleanse them. Certain people use the rocks from the crater, heating them, adding some hot water, and covering them with a blanket. The resultant steam is believed to provide spiritual purification.

Selected communities come to the crater to slaughter animals such as chickens in accordance with their ancestral rituals. The site is admired by the Zionists, and traditional healers from all over the world gather at Tswaing as it is regarded to be an extraordinary place. People of different religions visit the site and pray to give thanks for its beauty and majesty.

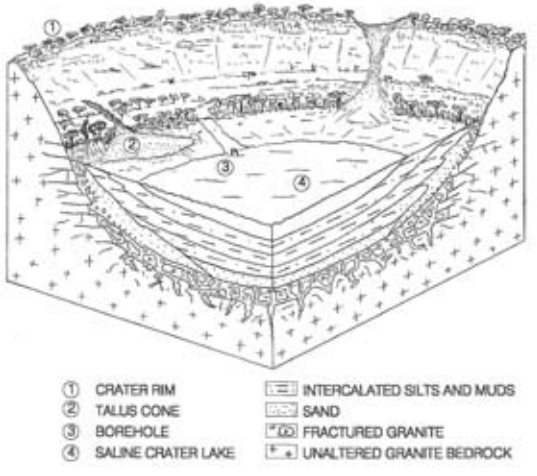


Figure 2.17 Schematic block diagram [cross-section through the crater] showing different features of the crater environment and interior, as well as some sedimentary characteristics [Reimold et al, 1999:62]

Figure 2.18 View of crater floor and Southern crater rim from Northern rim [February 2009]

2.6 Fauna and Flora

Fauna

A variety of animal life is found within the Tswaing conservation area. Approximately 35 mammal species that include shrews, genets, mongooses, porcupines, moles, bats, field mice, impala, black-backed jackal, common duiker, steenbok, kudu, eland, zebra and the red hartebeest are found at the TMC.

Flora

The Tswaing area is located in a Mixed Bushveld zone. The vegetation varies between a dense, short bushveld and a rather open tree savanna. On shallow soils the red bushwillow [*Combretum apiculatum*] dominates the vegetation [Low and Rebelo, 1998:26].

The buffalo thorn [*Ziziphus mucronata*], also known as the blinkblaar-wag-'n-bietjie, is also found around Tswaing. The symbolism locally associated with this tree is that the long thorns symbolise the fact that one should focus on the future, while the short thorn is a reminder to remember one's roots.

Lichens are minute to microscopic-scaled plants which consist of algae and fungi living in symbiosis. These lichens cause weathering on the surfaces of rocks. Lichen species are divided into two major groups: an 'epilithic' group that grows on the surface, and an 'endolothic' group that grows inside the rock. Lichens display many colours such as yellow, brown, orange, red, green, grey and black. The variety of lichen species on the different sides of the rocks in this area clearly illustrates the differences in local temperature and moisture conditions [Reimold, 1999:132].

Figure 2.19 Lichens on the crater trail [February 2009]

Figure 2.20 Natural vegetation at TMC. View towards M35 and Pretoria North from north-eastern crater rim [February 2009]

Figure 2.21 View towards Southern rim of crater and Pretoria [February 2009]

Figure 2.22 Natural vegetation at the TMC [March 2009]

2.7 Historical Context

Thousands of years ago, after a blazing meteorite slammed into the Earth's crust, small nomadic Middle Stone Age tribes came to Tswaing from time to time to hunt, gather edible and medicinal plants, and collect salt. They made tools and weapons of stone, bone and wood. Remnants of these artefacts were found mainly along the riverbeds and in close proximity to the road leading to the crater floor. As the Tswaing rock is not really suitable for the making of these implements, they were probably brought from elsewhere.

A few small artefacts dating from the era between the Stone Age and Iron Age were found and are presumed to have been brought to Tswaing, possibly by ancestors of the San [Bushmen]. Shards of decorated clay pots found on the crater floor indicate that the Iron Age people were early Sotho or Tswana-speaking communities, also known as the Moloko.

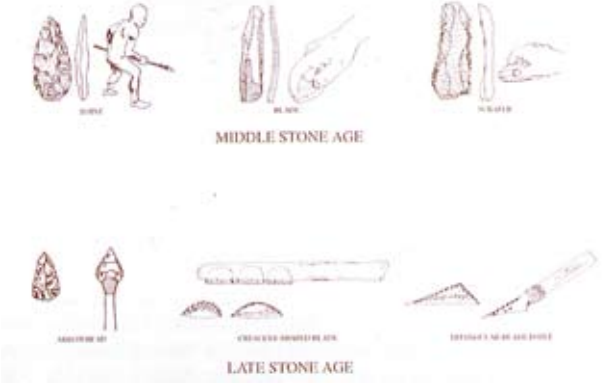


Figure 2.23 Middle and Late Stone Age artefacts found at Tswaing Crater [Reimold et al, 1999: 120]

Figure 2.24 Examples of decorated and undecorated potshards found at Tswaing [Reimold et al, 1999, :121]

During the 1850's, Boer settlers started dividing the region north of the Magaliesberg into farms. The crater was located on the Zoutpan farm. Animals came here for the salt, and lead bullets that are still being found on the crater floor indicate that Tswaing was a popular hunting area. Primitive salt extraction had already been established as the main activity at Tswaing. On 31 October 1876, ownership of the farm was formally vested in the ZAR Government through Deed of Grant 1419/1876.

During the 1890's, Zoutpan [Salt Pan] was properly surveyed and the north-eastern corner became a new separate farm named Uitspan [Resting Place].

Until 1902, salt was obtained from shallow evaporation ponds. A road for ox-wagons was constructed. Rights to obtain salt were leased to individuals by the government; these individuals then regulated the collection of salt by farmers and other private individuals.

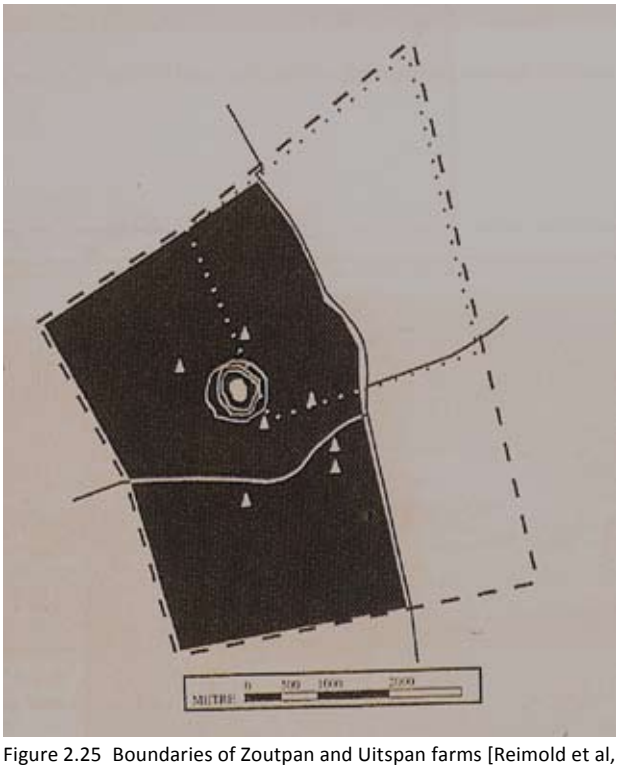


Figure 2.25 Boundaries of Zoutpan and Uitspan farms [Reimold et al, 1999: 121]

In 1912, South African Alkali Ltd started the systematic mining of soda deposits. In 1913 South African Alkali Ltd erected furnaces on the southeast rim of the crater to produce calcined trona, for which there was a big market on the Witwatersrand. A tram line was laid and a steam-powered hauling engine was put into operation.

In 1918, the first lease [started in 1912] was renewed for two successive periods of seven years. Production suffered dramatically due to the extensive exploitation of the rich trona deposits on the surface. W. Mauss, a German consulting chemical engineer, was employed and he reported that the Windram-Williams process was effective and recommended the construction of a new factory.

In October 1918, the process to obtain soda from the brine instead of the mud was perfected and the Windram-Williams process was abandoned. A patent application was made and plans to erect a new production factory were initiated. The factory site was chosen and construction began. A cutting [currently known as Mauss's cutting] was made in the southern crater rim to enable direct haulage between the crater floor and the new factory.

In 1921, more funds were procured, and the factory erected in 1919 was put in operation again. Production was not a success. H.R. Blumberg, a chemical engineer who later became the general manager, developed a method – later perfected by Clark and Partner – to extract all the salt and soda from the brine. The factory was gradually enlarged to accommodate these methods.

In 1949, five test wells, each with a diameter of 1m, were sunken into the crater floor to test its soda and salt content. Although there was sufficient soda and salt lower down, production costs would have been too high, and extraction was therefore not feasible.

Figure 2.26 The earliest known photograph of Tswaing, taken by H.F. Gros in 1889 [Reimold et al, 1999: 122]

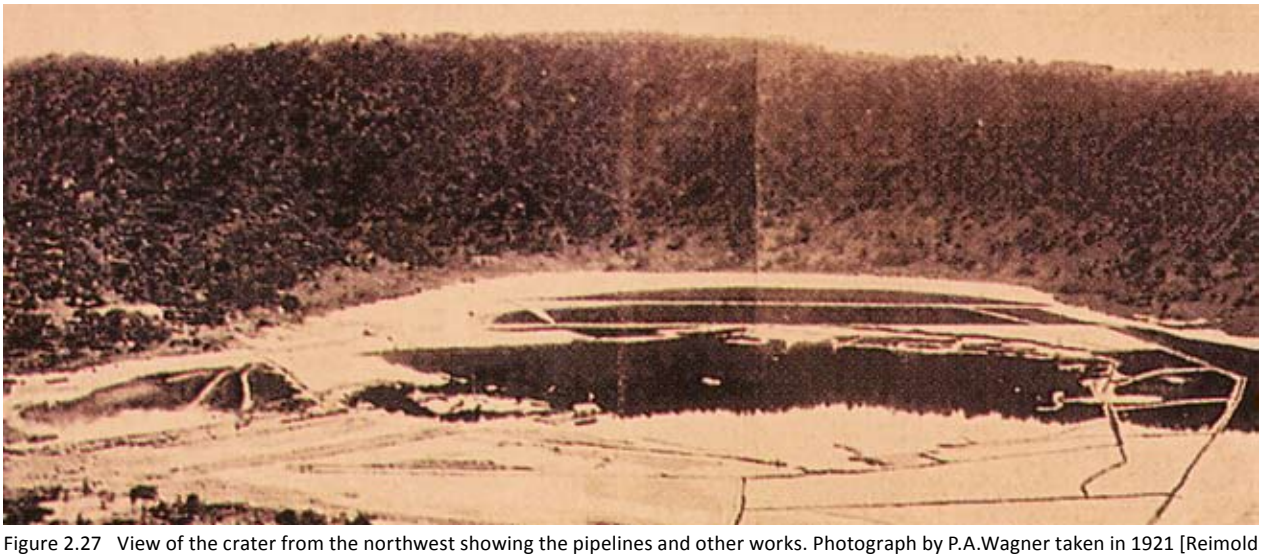


Figure 2.27 View of the crater from the northwest showing the pipelines and other works. Photograph by P.A.Wagner taken in 1921 [Reimold et al, 1999: 122]

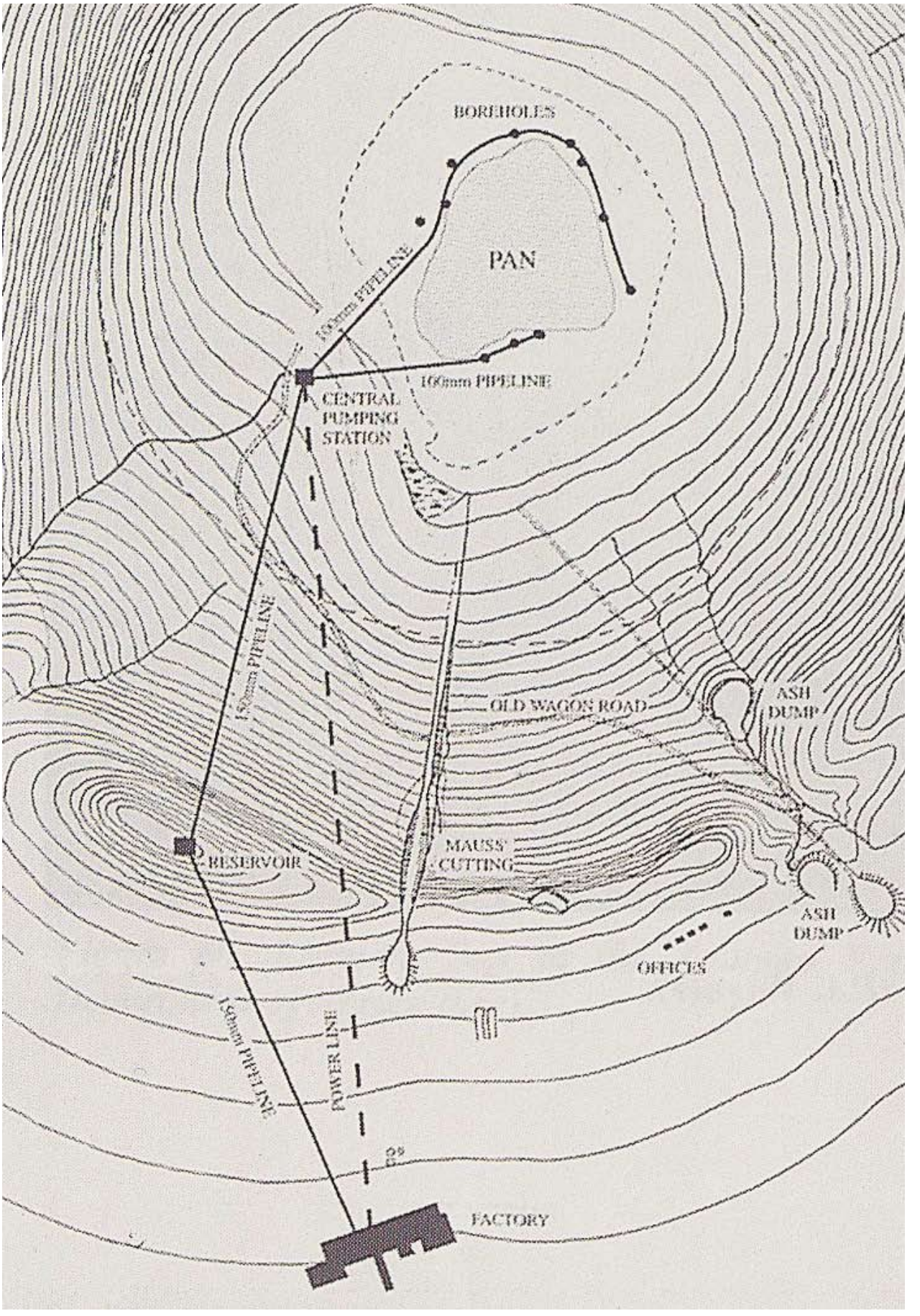


Figure 2.28 Plan of crater area showing bore holes, pipelines, central pumping station and reservoir [Reimold et al, 1999: 123]

In 1953, Zoutpan was resurveyed and subdivided into separate areas. The smallest area was leased to South African Alkali Ltd for the mining of soda and salt and for grazing the animals that were used, such as donkeys and mules. Grazing and other land-use rights of the 1 880 hectares, the largest part of Zoutpan, were transferred to the Department of Agriculture.

In the period between 1954 and 1956 the production of soda-ash resumed. Grazing camps were established on the remainder of the Zoutpan farm, water bore-holes were drilled, drinking troughs were built, a cattle herd was assembled, and staff was appointed to carry out experimental farming.

Mining at Tswaing came to an end in 1956.

Between 1958 and 1961, part of the old factory at Tswaing was used by a chemical engineering company, Palframan and Horner, who attempted to produce salt. All that remained was a stockpile of whitewash as a silent witness to the attempts to whiten the brownish colour of the small quantity of salt that was produced. The machinery was removed and sold or re-used elsewhere. All the roof plates, doors, windows, and any other useful items were removed from the houses.
The machinery was removed and sold or re-used elsewhere. All the roof plates, doors, windows, and any other useful items were removed from the houses.

During the 1970's all the houses were demolished, leaving only the foundations.

In 1992, The Zoutpan Experimental Farm was closed down, after which the National Cultural History Museum took it over.

On 30 March 1996 the Tswaing Crater Museum was officially opened.

During 2001, Gauteng Nature Conservation invested in the Tswaing area by providing infrastructure and staff members to monitor the wildlife. Game such as kudu, eland and zebra were resettled at Tswaing.

In 2003, the crater was drilled in collaboration with the international Continental Scientific Drilling Programme [ICDP] and Geoforschungszentrum [Potsdam, Germany] [Bewsher, 2005: 5].

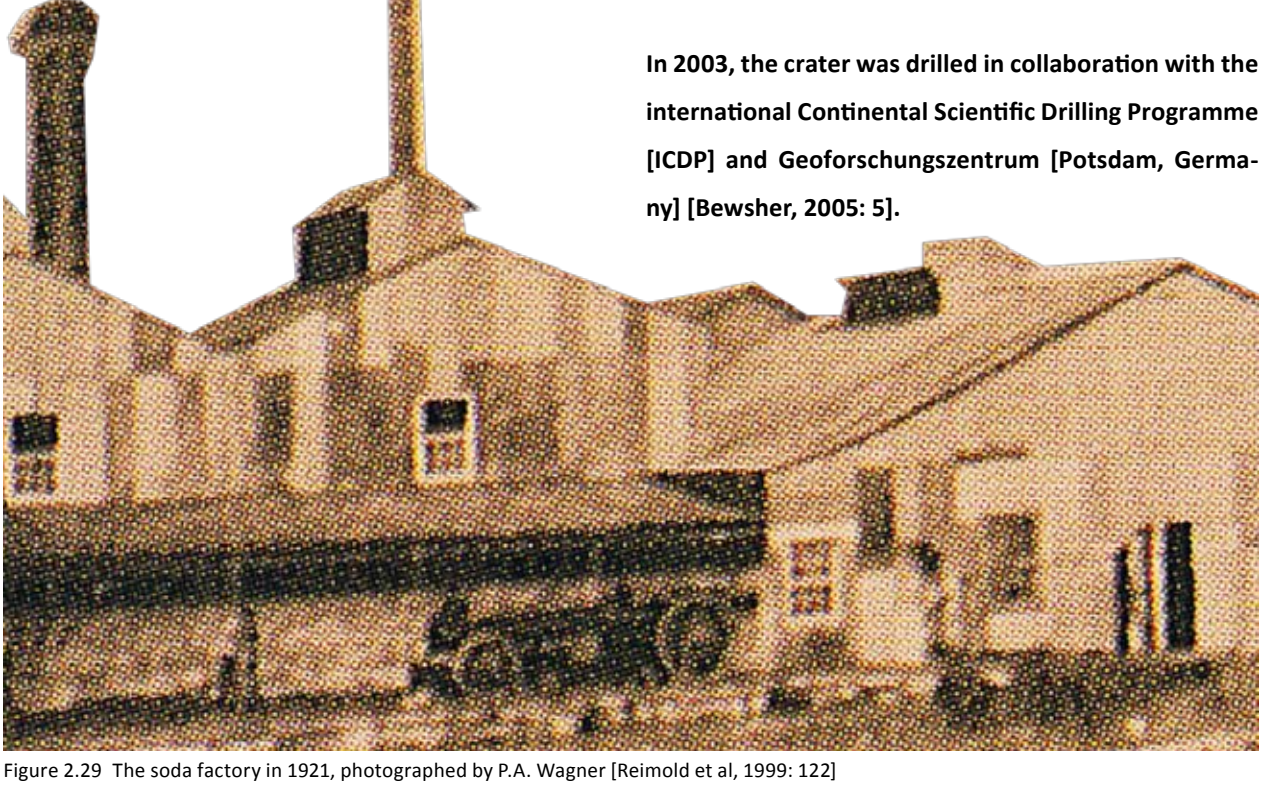


Figure 2.29 The soda factory in 1921, photographed by P.A. Wagner [Reimold et al, 1999: 122]

On 23 August 2009 a fire was started outside the fence of the TMC. The fire spread, burning down the visitor centre constructed in 1996, and 500ha of the nature reserve.

Figure 2.30 The TMC after the fire destroyed 500 ha and most of the existing visitor centre on 23 August 2009 [August 2009]

2.8 Environmental guidelines and policies

Environmental conservation

Tshwane Open Space framework [TOSF]

The Tshwane Open Space Framework endeavours to define and classify open spaces in Tshwane in order to provide a network of quality public spaces that fulfil the requirements of high environmental standards [Tshwane Municipality, 2005:5].

According to this framework, Tswaing Crater would be classified as a Green node, as it serves as a conservation area and is of irreplaceable value [Tshwane Municipality, 2005:24]. It states that the natural character of the site should be maintained and any human intervention should be sensitively located and have a minimum footprint. Activities suggested include research, education, conservation and eco-tourism [Tshwane Municipality, 2005:25-28].

Sites identified as protected and of irreplaceable value, such as Tswaing, will be subject to an Environmental Impact Assessment before human intervention may take place. Integrated Environmental Management Plans must be drafted in order to maintain the protected area [Tshwane Municipality, 2005:155].

Figure 2.31 Map of green nodes in Tshwane with Tswaing indicated. [Adapted from www.tshwane.gov.za accessed 15.03.2009]

World Cultural and Natural Heritage conventions

United Nations Education, Scientific and Cultural Organization [UNESCO]

In this document, UNESCO describes natural heritage as natural features or natural sites that are of outstanding universal value from the point of view of science, conservation or natural beauty [UNESCO, 1972:2].

As Tswaing is a young impact crater, it is very well preserved compared to the Vredefort Dome in the Free State which is 2020 million years old and severely eroded [Reimold, 1999:31]. For this and many other reasons it is of great importance that the Tswaing Crater is considered for declaration as a future World Heritage site, as this would imply stringent protection and conservation measures that will improve the chances of survival of this significant site.

Each site on the list of World Cultural and Natural Heritage sites is evaluated and treated individually by the World Heritage Committee. Concepts that are emphasised in the document are those of education and awareness. It clearly states that appreciation and respect for the site should be transferred in educational programmes and that the public be informed of the dangers that threaten heritage sites [UNESCO, 1972:13].

03 THEORETICAL DISCOURSE

The Theoretical Discourse focuses on the intangible dimensions related to architecture such as memory and experience. It is important to consider the intangible dimension in architecture as essential element, for as Marshall McLuhan points out, '[e]verybody experiences far more than he understands. Yet it is experience, rather than understanding that influences behaviour' [Perkins, 1995: 2].

3.1 Experience in architecture

In *The palace at 4A.M.* Alberto Giacometti's surrealistic sculpture becomes a 'stage for his ideas, on which the primordial drama of life, love and death are coded with a dream.' In the same way, architecture becomes a stage for the architect's ideas. The difference, and this is the important part, lies in the fact that the architect's ideas, transformed into a structure, will be experienced by actual human beings – its users.

However, later in his life Giacometti started to question the 'Threat to Humanity' further when he came to realise that 'we perceive each other merely as an "apparition" surrounded by space, within a certain field of vision and perspectively reduced.' It was this idea of perception that Giacometti experimented with in his sculptures. During this same period Maurice Merleau-Ponty published Phenomenology of perception in which he asserts that the way in which a situation is perceived is greatly influenced by its concrete reality. Giacometti changed the way in which sculpture was regarded. 'He was the pioneer of the anti-Cartesian counterpoising to Cubism that replaces rational systems with experienced perception, knowledge with specific experience' [Ruhrberg, 1998:487-490].

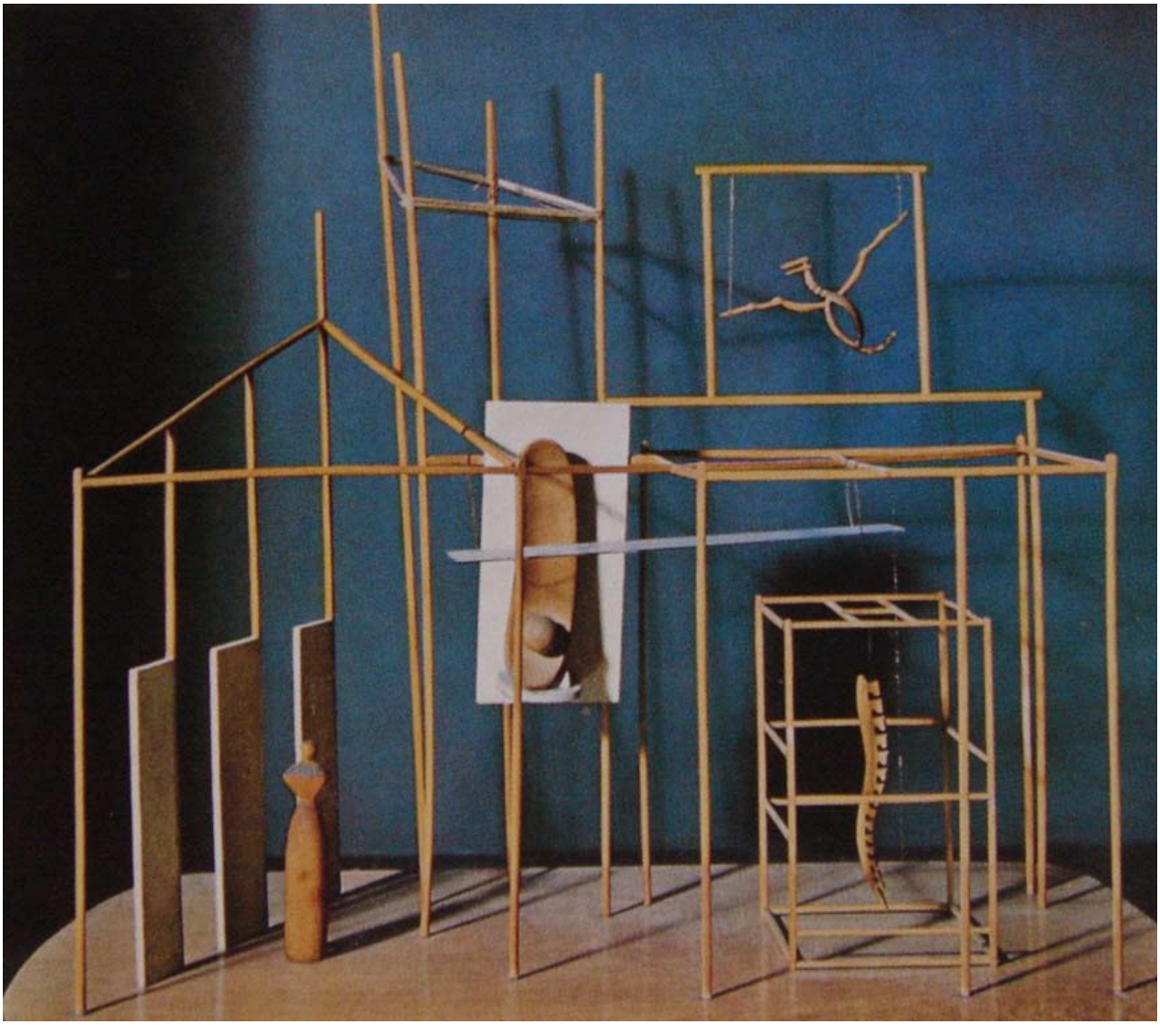


Figure 3.01 The Palace at 4A.M. , Alberto Giacometti [Ruhrberg, 1998:465]

The experience of architecture is an intimate one that depends on unifying the experiences of the body and the mind. Human inclinations and actions cannot exist by themselves.

Immateriality, which includes feelings, hopes and desires, can be regarded as a powerful driving force in life. Immateriality makes people do things and want things. Experience can be seen as immaterial action. Immateriality, what people do and how they react, cannot be controlled. Immateriality can however be influenced by the physical. Architecture can be considered to represent the physical, i.e. the material. The actual immateriality of participation is what elevates the material. Architecture can therefore not exist without the participation of the human being, and consequently, the experience of architecture is what drives the immaterial quality of the material. Architecture becomes the design of the physical environment within which the human being experiences life on a daily basis.

Phenomenology is considered to be the interpretive study of human experience. Architecture therefore plays a dramatic role as the arena in which everyday life and its related 'performances' take place. As Sir Winston Churchill once said, 'we shape our buildings: thereafter they shape us.' [Perkins, 1995:62].

We exist on Earth as souls in our bodies. Our body is that which facilitates the interaction between our minds and the real world. This occurs through our senses – sight, touch, smell, hearing and taste – and some argue that there are more than these five senses, such as thermal sensitivity.

Peter Zumthor is an architect who firmly believes in the psychological effect that buildings have on their dwellers. He acknowledges the fact that we experience our environment on a conscious level in his architecture, and clearly states that the experience of architecture goes beyond our daily interaction with functional spaces. He says that to experience architecture in a concrete way means to touch, see, hear and smell it, to discover and consciously work with these qualities. [Zumthor, 2006: 10].

Figure 3.02 Thermal Baths Vals, by Peter Zumthor [www.presidentsmedals.com accessed 29.09.2009]

It is therefore important to acknowledge this psychological dimension in architecture and to design with more than one sense of the human being in mind, for as Marshall McLuhan points out, '[e]verybody experiences far more than he understands. Yet it is experience, rather than understanding that influences behaviour' [Perkins, 1995: 2].

When nature, materials and light are integrated as design elements, the metaphysical element in architecture comes to life as the sensory experience is stimulated. When the mind and body feel different than usual on entering a building, we are experiencing its space.

Architecture is part physical and part metaphysical. The art of design lies in understanding and translating the metaphysical. The work of Peter Zumthor can be regarded as an example of achieving the metaphysical in architecture. Zumthor designs spaces that enhance the natural and the real world, and consequently, the users dwell in relation with the environment. An effect is shaped in the person; he makes him wonder about the most basic components of life. He refers to architecture thus:

***Architecture has its own realm. It has a special physical relationship with life. I do not think of it primarily as either a message or a symbol, but as an envelope and background for life, which goes on, in and around it, a sensitive container for the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep'* [Zumthor, 2006:12].**

Figure 3.03 The Fur-Lined Teacup Object by Meret Oppenheim [Ruhrberg, 1998:463]

Architecture can no longer be regarded as mere buildings; it becomes the container of poetry, thoughts and dreams. The magic of architecture, the memory of an experience, the shaping of a thought all take part in the meeting of the conscious with the unconscious.

Zumthor uses sensory stimuli to trigger feelings and ideas within a person. He intends to penetrate the human mind by using sight when views of the mountains are framed. The way one feels within one's own skin is experienced by means of different temperatures, and memories of the individual's past are triggered through the sense of smell. These sensory stimuli create an awareness within the person to fully experience the space he finds himself in. The individual is stimulated to wonder, to be fully aware of life and of where he dwells.

3.2 Memory

Humans experience their surrounding environments by means of stimulation and integration of the five senses. These produce images within the mind and therefore create memories that can later be recalled and relived. These memories influence future experiences and the way in which other environments will be experienced.

In the essay *Carlo Scarpa: built memories*, Anne-Catrin Schultz refers to two kinds of memory that exist, i.e. direct and indirect memory. Indirect memory refers to the narrative component, to the evoking of historic places or elements, as opposed to the direct memory that refers to a building's original shape or style. Insightful meaning is added to architecture when the direct and indirect memory incorporate the narrative into the structure. Architectural details and symbols enable the structure to relate to its historic and local context.

It is often difficult to preserve a memory and consequently keep it alive. Memory is inherently a living element and its preservation would entail freezing a moment in time, directly opposing its inherent nature.

According to Francis Yates, '[o]ne has the impression that memories are most carefully built up with memory architecture, with architectural places reflected within. The art of memory is an invisible art; it reflects real places but is about, not the places themselves, but the reflection of these within the imagination" [Birksted, 2000:48].

The role of architecture should therefore be re-evaluated in relation to memory and its preservation. As memory can be regarded as part of the intangible dimension of space and time, the experience of architecture and its metaphysical elements can be considered to be a means of enabling the memory to stay alive as it becomes part of the metaphysical world of the user. Weaving individual experiences of atmosphere, space, scale, materiality, light and so forth into the architecture enables a memory to continue within the individual's imagination, keeping the memory alive through the human mind as a vessel of remembered experience.

Architecture can be seen as central to the idea of remembering. Memories are created, transformed, or for that matter, imagined in relation to place. Architecture is the formal configuration of place within space, acting as a reference point for memory. As Ruskin states:

It is as the centralisation and protectress of this sacred influence, that architecture is to be regarded by us with the most serious thought. We may live without her, and worship without her, but we cannot remember without her [Ruskin, 1849:181].

04 PRECEDENT ANALYSIS

The precedent analysis illustrates various architectural and art interventions related to the range of design principles employed in the design proposal such as route, memory and experience. Carlo Scarpa's intervention at the Castelvecchio is regarded as the ultimate precedent study for this project, with the exceptional level of detailed design incorporating existing structures, exhibition design and elements of memory.

 Figure 4.01 Path towards understanding Pavilion [www.kalkriese-varusschlacht.de/index/getlang/en accessed 2009.08.11]

4.1 Historical Park

Kalkriese, Germany

Architect : Gigon/Guyer

The Historical Park was selected as a precedent study because of its emphasis on route, the archaeological relevance of the intervention, and the experiential play expressed by the architecture and exhibition design.

Creating a memorial to a battle of mythical importance with no obvious surface traces necessitated architectural imagination of great sensitivity which has overlaid past with present, place with narrative, time with space. **[Davey, 2002:34]**

Archaeologists determined that an area of approximately 20 hectares of forest and farmland at Kalkriese in northern Germany is the long-lost site of the battle of the Teutoburger Wald that took place in AD 9.

The winning design by Annette Gigon and Mike Guyer for the archaeological museum and park displays poetic insight, gentleness and thoughtful economy.

Seeing, listening and understanding are the main experiential objectives of the museum. All the buildings touch the earth lightly, and have the underlying intention of being removed at a later date to enable archaeological studies to continue.

The seeing pavilion has a camera obscura lens bulging out of the front of the box, providing a fish-eye view of the park. The hearing pavilion's galvanised steel ear-trumpet evokes memories of listening devices from the First World War, while the Understanding pavilion houses nine screens upon which television clips of contemporary conflicts are shown.

Figure 4.02 Museum tower [Davey, 2002:37]
Figure 4.03 Seeing pavilion [Davey, 2002:41]
Figure 4.04 Hearing pavilion interior [Davey, 2002:41]

4.2 Showroom
Pfalz, Germany
Architect: FNP Architekten

The Showroom was selected as a precedent because of its sensitive response to the existing structure, and the resultant value-added design intervention.

The 1780 pigsty structure was partly destroyed during the Second World War. Plans were initially made to rebuild it to accommodate a showroom, but economic circumstances made this unfeasible.

The sensitive solution was to place a house within a house. For logistic and economic purposes, the architect designed a timber structure with a replicated facade of the original structure to be placed within the existing ruin without touching it. A roof was placed over the entire structure to protect both the new interior as well as the dilapidated exterior from further deterioration.

At night visitors can pry into the gaps between the structures and wonder how it was all done as light, colour and warmth transform the building. *The new internal life extends the eighteenth century into the twenty-first.* **[Finch, 2005:47]**

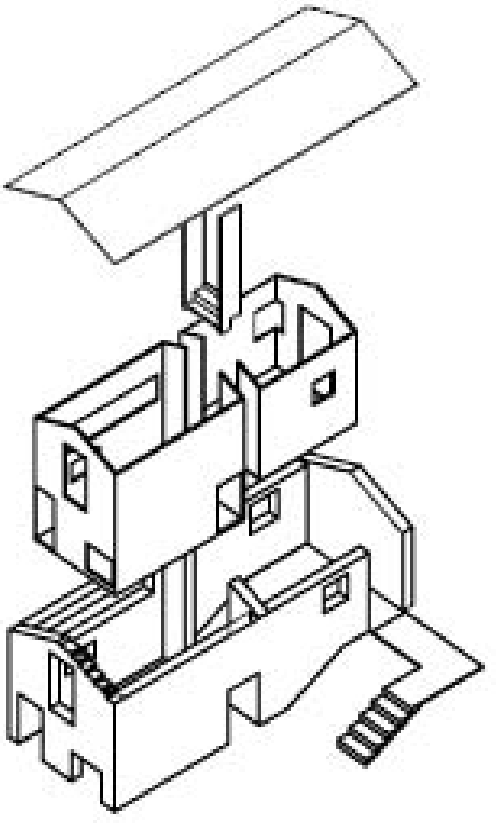
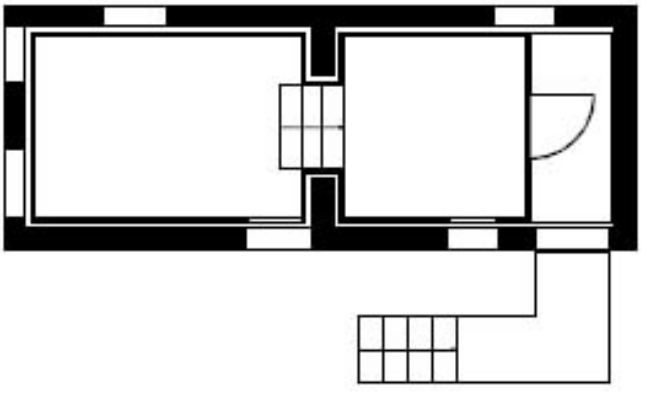


Figure 4.05 The restored building [Finch, 2005: 46]
Figure 4.06 Inserting the new structure [Finch, 2005:47]
Figure 4.07 Exploded isometric projection [Finch, 2005: 47]
Figure 4.08 Captivating integration of the old and the new [Finch, 2005:47]
Figure 4.09 Ground floor plan [Finch, 2005:47]



4.3 Carlo Scarpa and the Castelvecchio

Carlo Scarpa worked on the Castelvecchio Museum in two phases, from 1957 to 1964 and again from 1967 to 1973. The project was finally completed in 1973. The Castelvecchio was selected as precedent for several reasons: firstly for the design of the museum and temporary exhibition; secondly for the fact that the project is situated within a historic structure that presented certain constraints; and thirdly for the exceptional detailed design and sensory experience that Scarpa mastered in this project.

Figure 4.10 Detail of the paving edge at the threshold between the entrance room and the sculpture gallery. A tiny cascade of levels formed from white Prun stone. [Murphy, 1999:49]

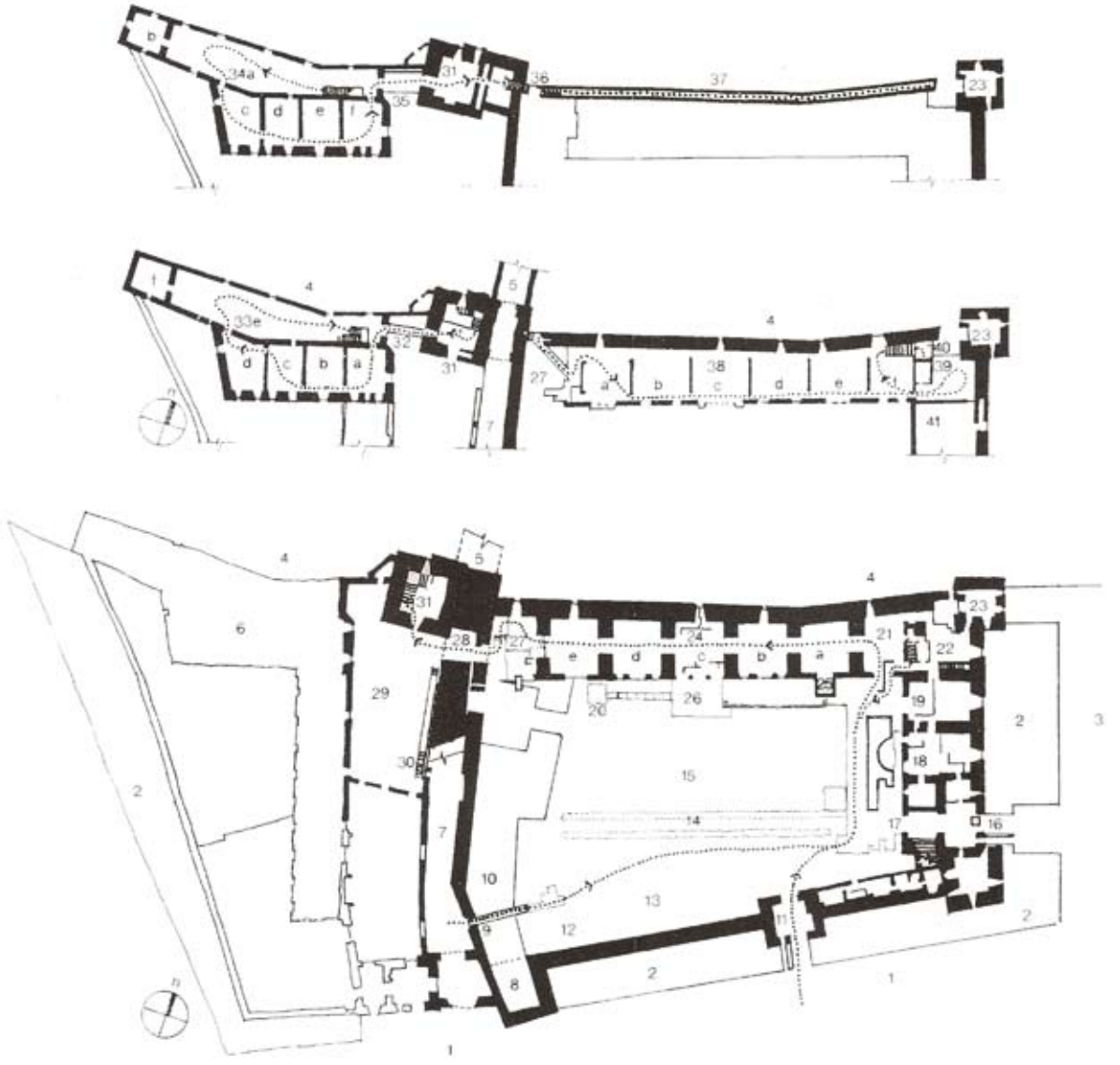


Figure 4.11 The Sacello seen from the first room of the gallery. The beam of sunlight moves around the space during the course of the day. [Murphy, 1999 :68]

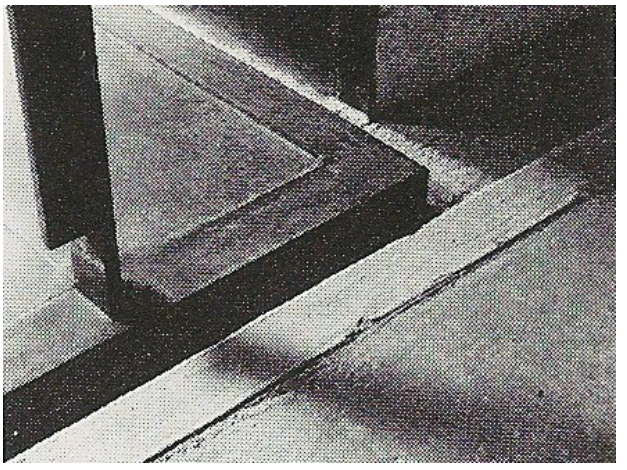


Figure 4.14 Detail of junction of steel support to steel edge; also shows the two adjacent floors separate from each other and the walls [Murphy, 1999:68]

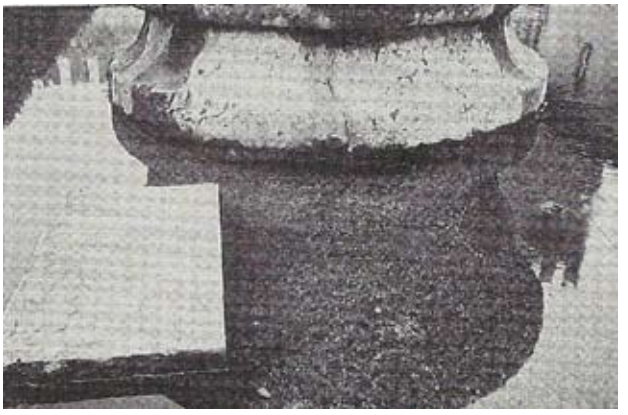


Figure 4.12 The fountain is detached to appear to float on the water [Murphy, 1999:29]

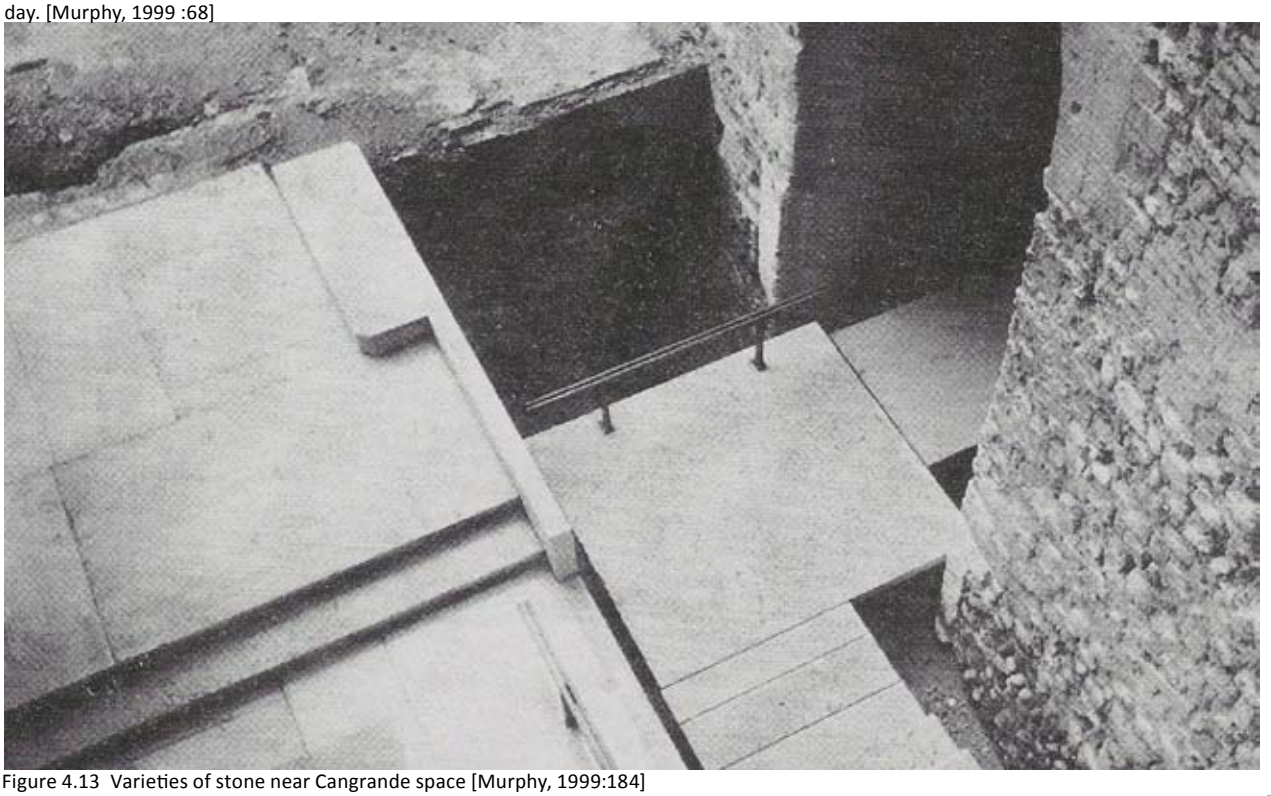


Figure 4.13 Varieties of stone near Cangrande space [Murphy, 1999:184]

4.4 Liliesleaf Legacy Project

Rivonia, Johannesburg, South Africa

Architects: Mashabane Rose Associates

The previous headquarters of the ANC's armed wing Umkhonto we Sizwe, located on the Liliesleaf farm, was recently [June 2008] transformed into a memorial open to the public. The project consists of a visitors' centre and a resource centre on opposite boundaries of the site. A clear distinction between the old and new structures is made by means of new materials. The project is essentially experienced as a journey through the landscaped route between the existing structures where the historic narrative of the site is explained .[Low,2008:42]

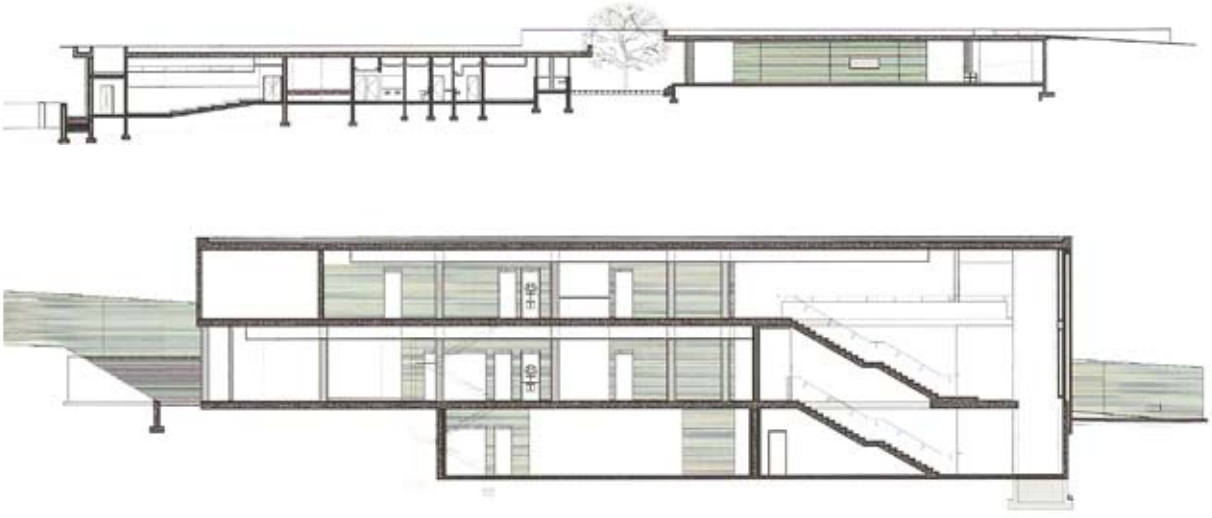


Figure 4.15 Section through visitor centre [Low, 2008:43]
Figure 4.16 Section through resource centre [Low, 2008:43]
Figure 4.17 View from visitor centre towards resource centre

Figure 4.18 View towards visitor centre and restaurant

Figure 4.19 New materials, doors and windows in conjunction with existing structure

Figure 4.20 Threshold between new and existing materials

Figure 4.21 Meeting between the old and the new

Figure 4.22 New exhibition design within previously existing structure

4.5 Centre for Contemporary Arts Nottingham (CCAN)

Nottingham, Nottingham shire, United Kingdom

Architect: Caruso St John

For this building Trent Concrete created and installed 1 100 square metres of green scalloped wall panels. A custom-made design, adapted from an intricate Victorian lace pattern found in a time capsule during excavations for a new shopping centre elsewhere in Nottingham, was applied to these panels.

The panels range from 4 - 11m in height, with the heaviest panel weighing 11.5 tonnes. The building is finished with a black polished concrete plinth of varying heights that surrounds the lower part of the building.

[www.trentconcrete.co.uk accessed 09.09.09]

Figure 4.23 Architectural animation of CCAN [www.trentconcrete.co.uk]

Figure 4.24 Close-up of green scalloped concrete panel with intricate lace pattern imprinted [www.trentconcrete.co.uk]

4.6 In die sterre geskryf ll [Written in the stars ll]

An installation piece by Berco Wilsenach at the Pretoria Art Museum

Visited on 11.03.2009.

The installation piece forms part of an encompassing 'Projek vir die Blinde Astronoom' ['Project for the blind astronomer'] on which the sculptor and installation artist Berco Wilsenbach has been working for the past three years.

Wilsenach's project investigates different tactile decoding systems with which the night sky can be explained to the blind. It can be described as a metaphor for the inaccessibility of language as a medium of communication. Braille is represented by randomly placed dots on a star map and the similarities between the map & the braille page are undeniable.

The installation consists of a series of star maps in glass where light is ironically presented as a tangible entity. The irony deepens in that the blind astronomer or observer cannot experience the visualised information even though it is mapped and tangible. On the other hand, the seeing observer does not have access to it either because he or she does not have the means to understand the visual images. Both remain in the dark [Pretoria Art Museum, 2009:1].

Although the installation is not necessarily translatable for the everyday art museum dweller, the exhibition does have a dramatic effect on the viewer. It is as though it is not necessary to understand the represented information; the experience that one has when moving through the artwork is more important. The different layers become enriched when viewed 'over' each other and in this way a whole new image is created. It is refreshing to be seduced into this fragment of magic.

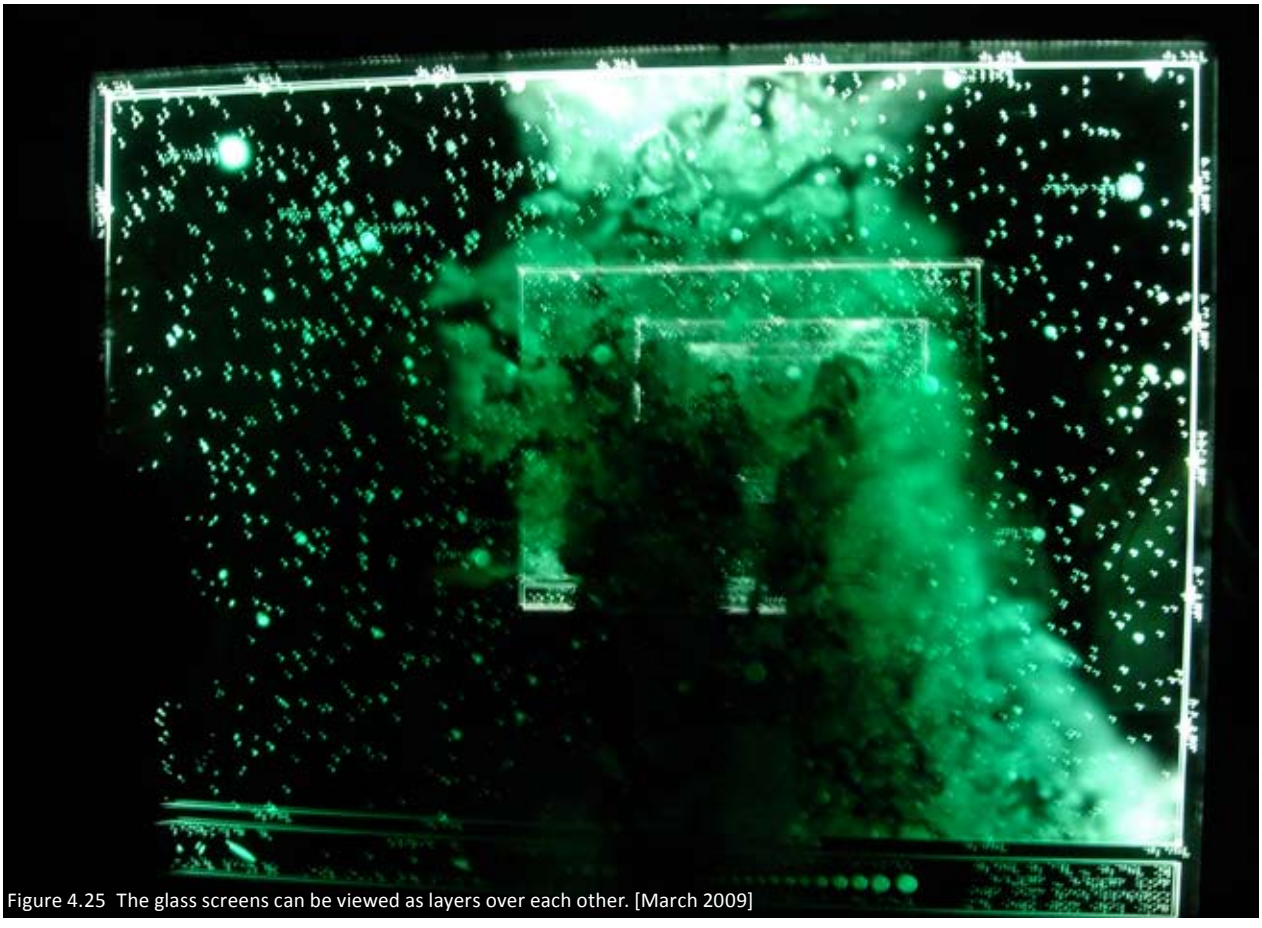
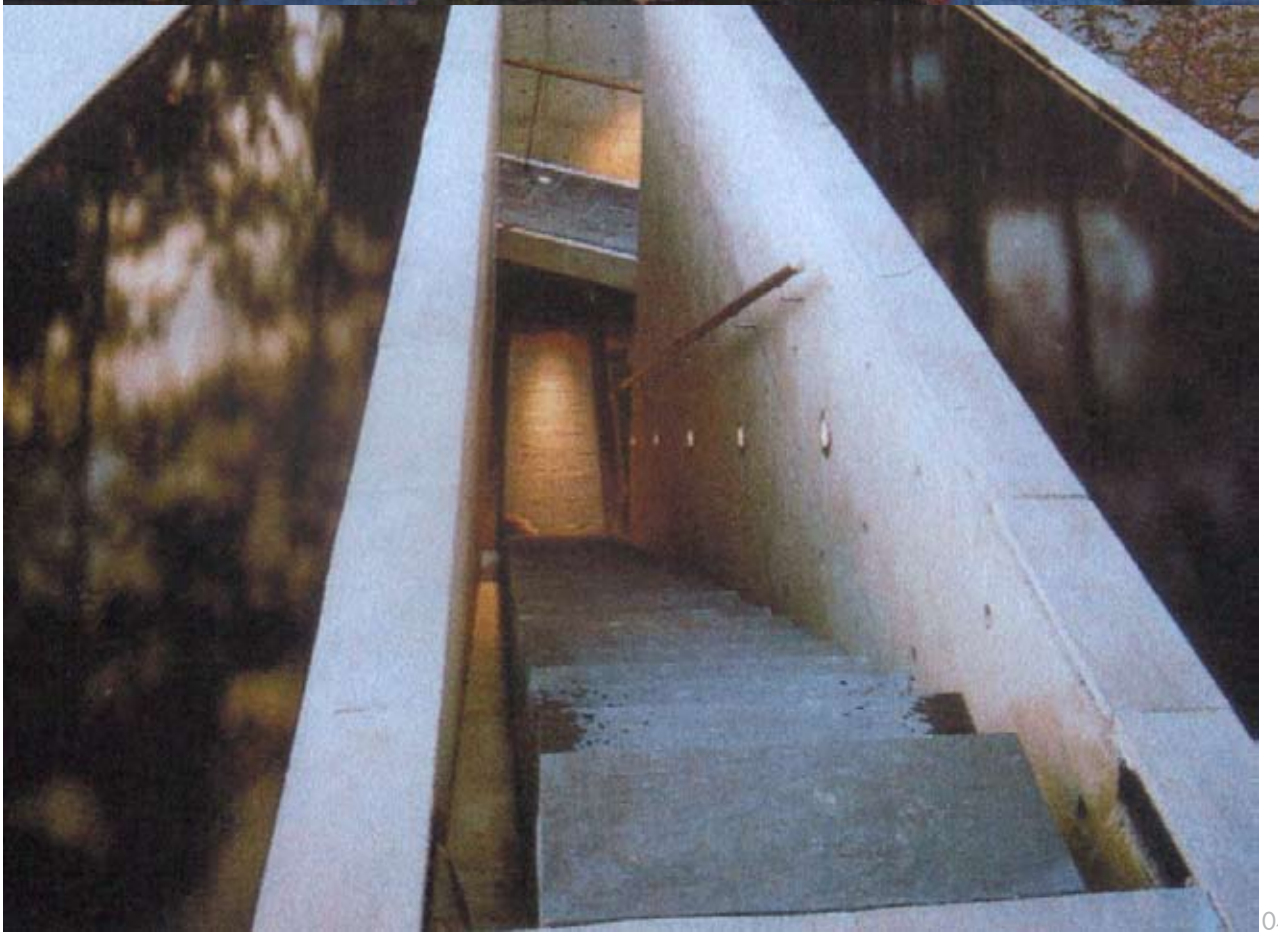
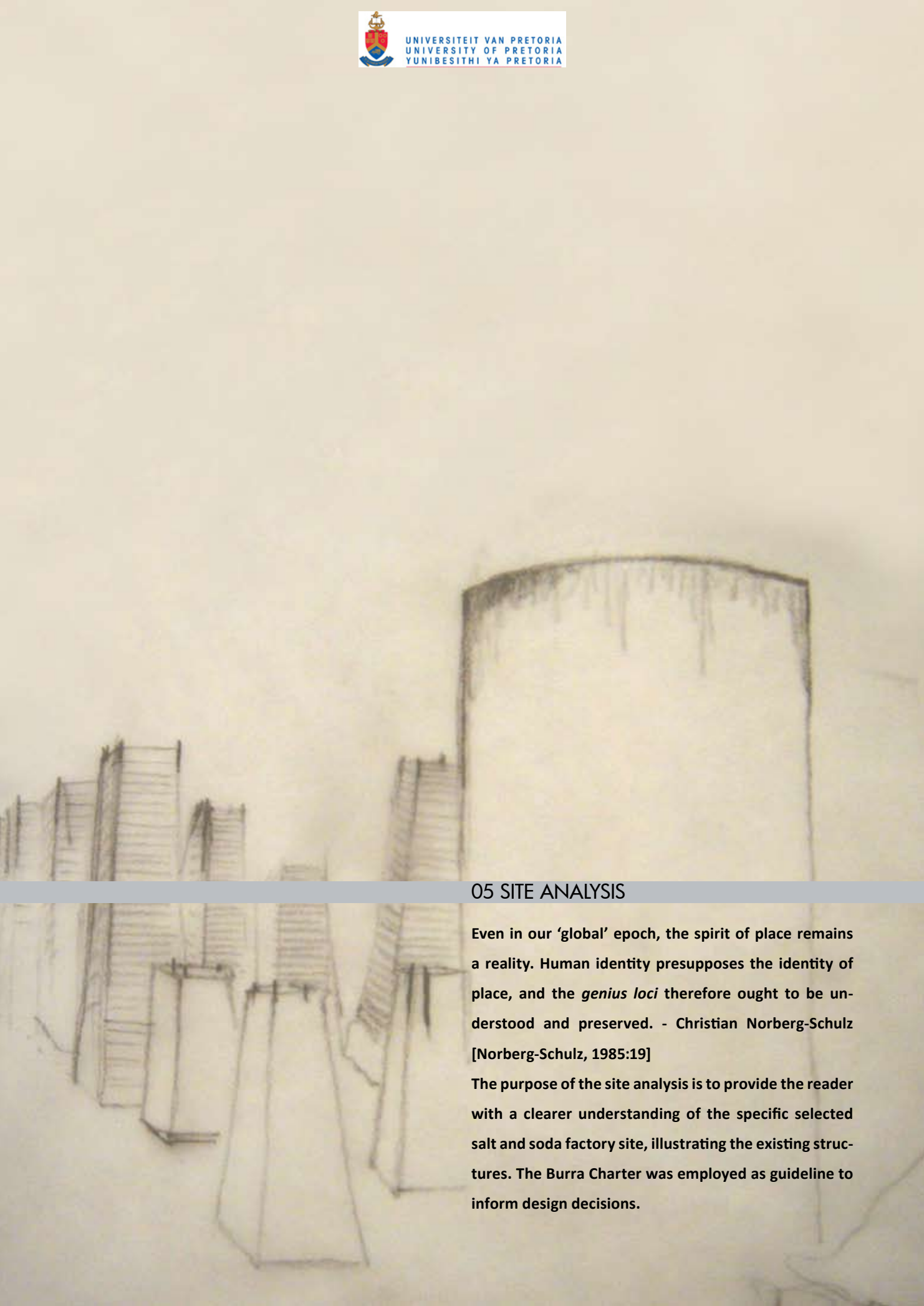


Figure 4.25 The glass screens can be viewed as layers over each other. [March 2009]

Louis-Jeantet garden courtyard

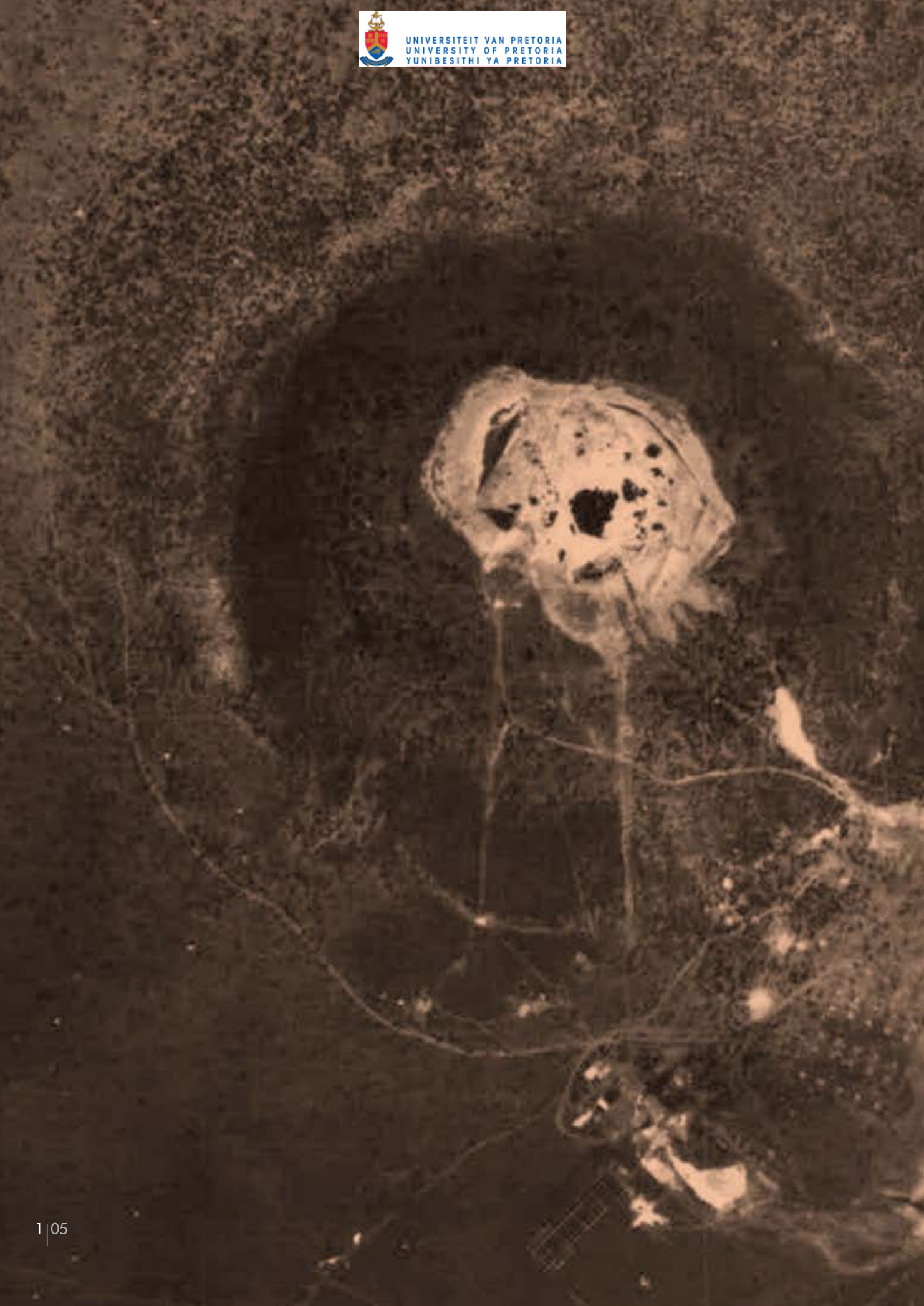




05 SITE ANALYSIS

Even in our 'global' epoch, the spirit of place remains a reality. Human identity presupposes the identity of place, and the *genius loci* therefore ought to be understood and preserved. - Christian Norberg-Schulz [Norberg-Schulz, 1985:19]

The purpose of the site analysis is to provide the reader with a clearer understanding of the specific selected salt and soda factory site, illustrating the existing structures. The Burra Charter was employed as guideline to inform design decisions.



The Burra Charter was selected as a guideline informing design decisions regarding the cultural significance of the site , with specific emphasis on the existing structures of the historic salt and soda factory.

The Burra Charter defines heritage as places and objects that have been inherited from previous generations that should be looked after and passed on to future generations. These places are important because of their influence in the shaping of communities, environments and generally where the associated societies are today.

Before any heritage related places or objects can be protected, their significance need to be determined, why and how they are important. The TMC is primarily important due to the impact crater on the site. The crater is significant in various aspects as discussed in the context analysis. Various other activities took place, and are still taking place up to this day due to the impact crater. The physical fabric of a place is the tangible evidence of what has once been and therefore, the selected focus area of this proposal is the remains of the salt and soda factory as physical structure.

A shorthand outline of the articles in the Burra Charter was used as primary guideline to determine the appropriate design intervention.

Figure 5.01 [On previous spread] Aerial photograph taken in 1939 [Chief Directorate: Land Surveys and Mapping]

5.1 The salt and soda Factory

For thousands of years the Tswaing crater has been a source of salt for human consumption, utilised by groups ranging from small nomadic Middle Stone Age tribes to the early Boer Settlers. Various methods were employed to extract salt and soda brine from the crater floor.

In 1918, the appointed consulting chemical engineer W. Mauss recommended the building of a new factory for the projected annual production of approximately 100 tons of refined soda-ash. The factory site was selected and construction got underway in 1918.

Due to increasingly competitive markets resulting in losses rather than profits, as well as declined production rates due to the extraction of the soda and salt content, production was stopped, and the factory was closed down in 1956.

Palframan and Horner, a chemical engineering company, used part of the old factory from 1958 to 1961 in an attempt to produce salt. Today, only a stockpile of whitewash remains as a reminder of failed endeavours. Machinery, along with all doors, roof plates, windows and other valuable assets were stripped from the factory to be re-used or sold elsewhere. During the early 1970's all the remaining shells of the houses on the site were demolished, leaving only abandoned footprints of remembrance on the landscape

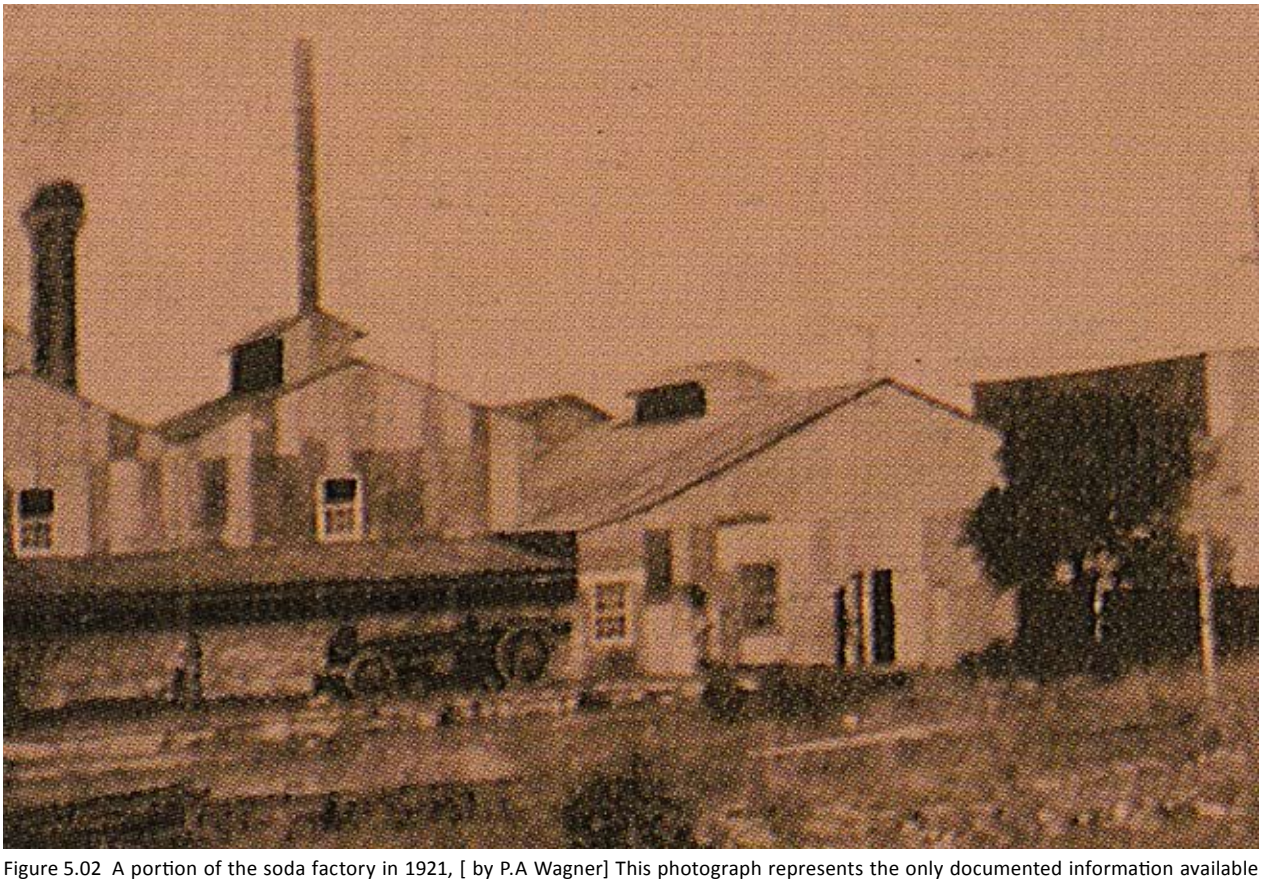


Figure 5.02 A portion of the soda factory in 1921, [by P.A Wagner] This photograph represents the only documented information available regarding the factory. [Reimold et al, 1999:124]

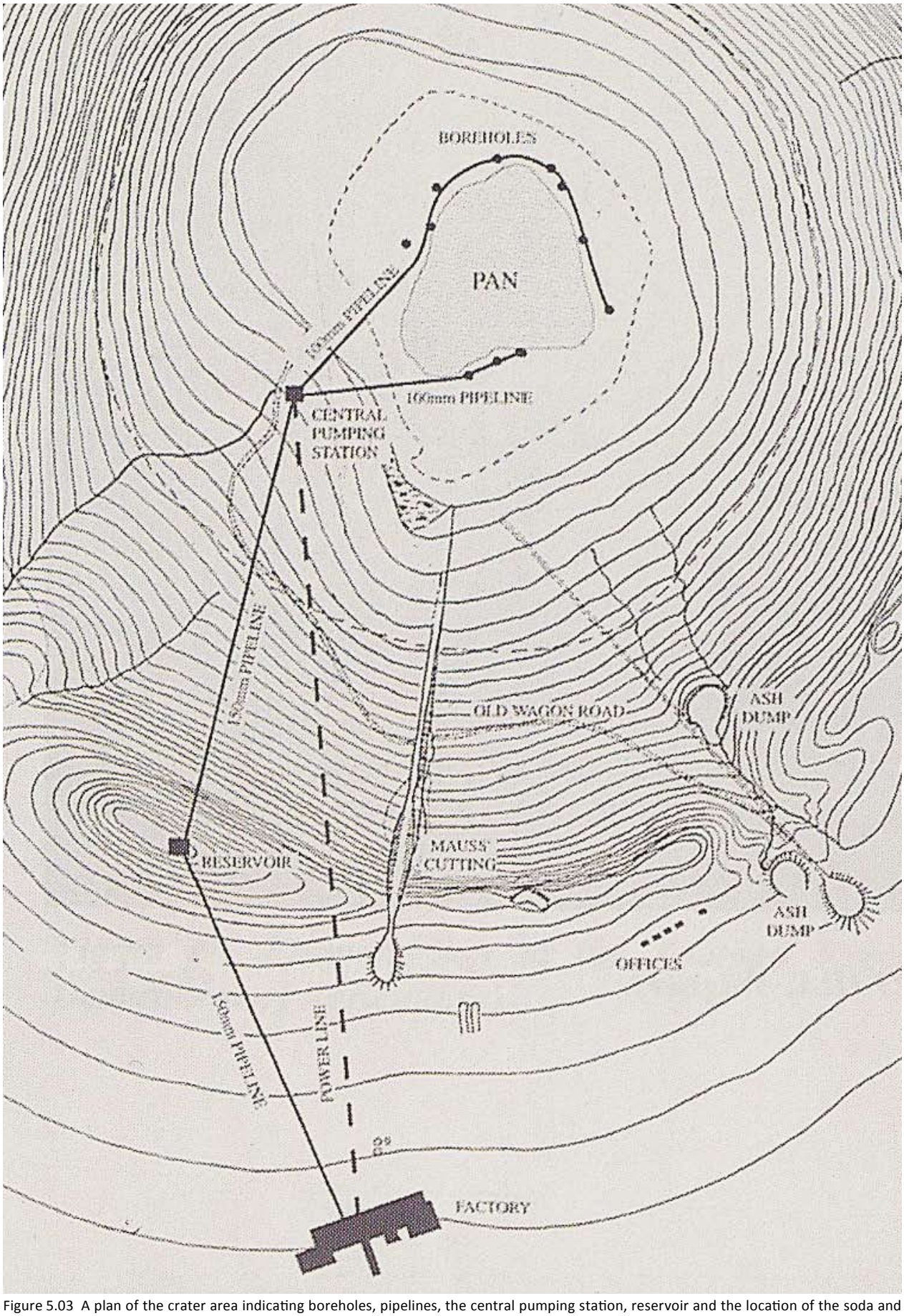


Figure 5.03 A plan of the crater area indicating boreholes, pipelines, the central pumping station, reservoir and the location of the soda and salt factory. [Reimold et al, 1999:123]

Today, only remnants of the old factory linger in the landscape, marked by a vast expanse of concrete flooring, in which corroded reinforcing, remnants of pipelines and the traces of floor partitions can be found. These have been left to decay and are slowly turning into heaps of rubble over time as nature takes its course and the structures are vulnerably exposed to the elements. Gradually, plants seek out the cracks, bursting through the concrete foundations upon which a profitable industry was formerly founded, the ruins ironically crumbling from the very foundations upon which they were once constructed – salt.

Documentation regarding the mining operations is limited. No visual records, with the exception of a photograph by P.A. Wagner taken in 1921, an aerial photograph from 1939, and a diagrammatic plan of the crater area, are available. The dilapidated structures are therefore the only visual reminders that remain. Various mining methods were employed over time, enabling researchers to make vague assumptions about the actual functioning of the factory and remaining structures – a riddle left for the imagination to explore.

While, ever and anon, there falls
Huge heaps of heavy moulder'd walls.
Yet time has seen, that lifts the low,
And level lays the lofty brow,
Has seen this broken pile compleat
Big with vanity of state:
But transient is the smile of Fate!
A little rule, a little sway,
A sunbeam on a winter's day
Is all the proud and mighty have
Between the cradle and the grave.
[Thompson, 1981:15]

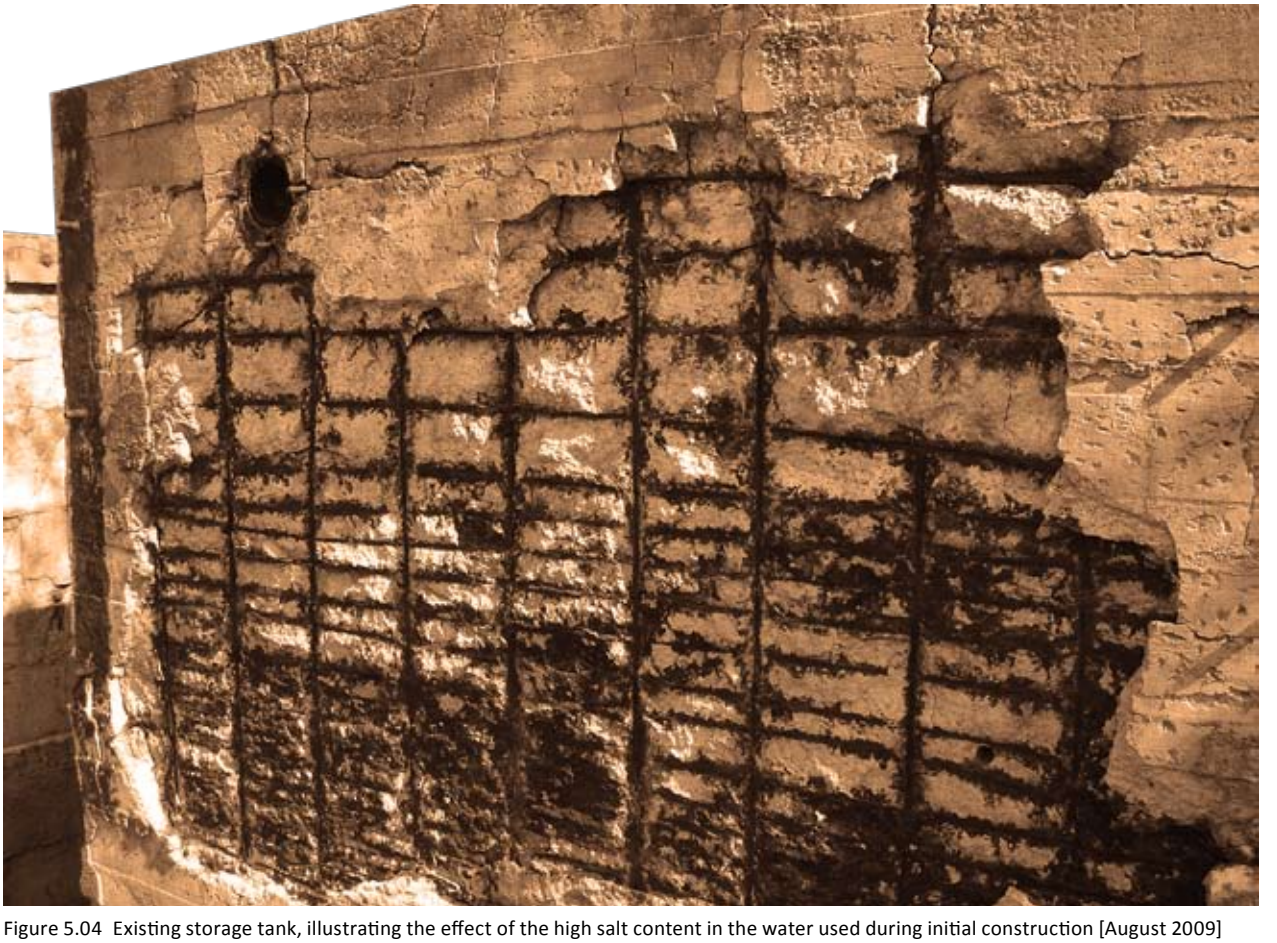


Figure 5.04 Existing storage tank, illustrating the effect of the high salt content in the water used during initial construction [August 2009]

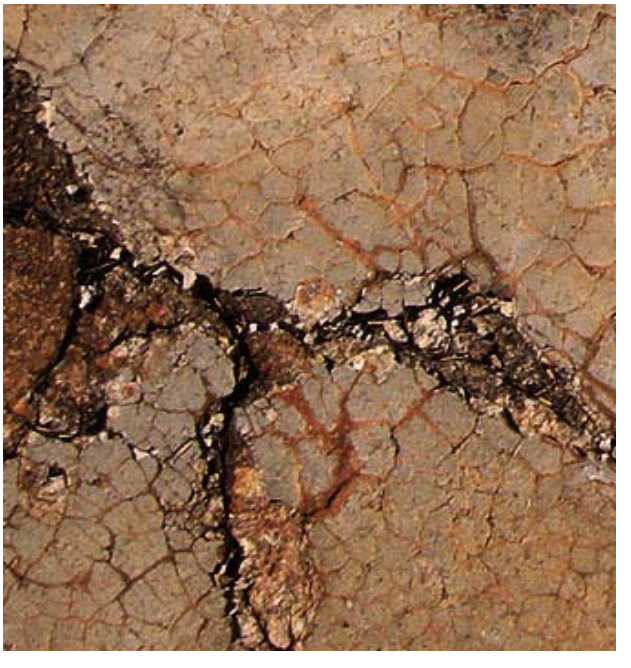


Figure 5.05 Corroded reinforced concrete storage tank structure [March 2009]
Figure 5.06 Storage tank, filled with dead leaves [August 2009]
Figure 5.07 Corroded steel element on top of concrete storage tank [June 2009]
Figure 5.08 Corroded reinforced concrete element [June 2009]
Figure 5.09 Residue of corroded element on concrete surface [June 2009]
Figure 5.10 Cracked concrete surface [June 2009]

Figure 5.11 Dilapidated reinforced concrete storage tanks filled with rainwater

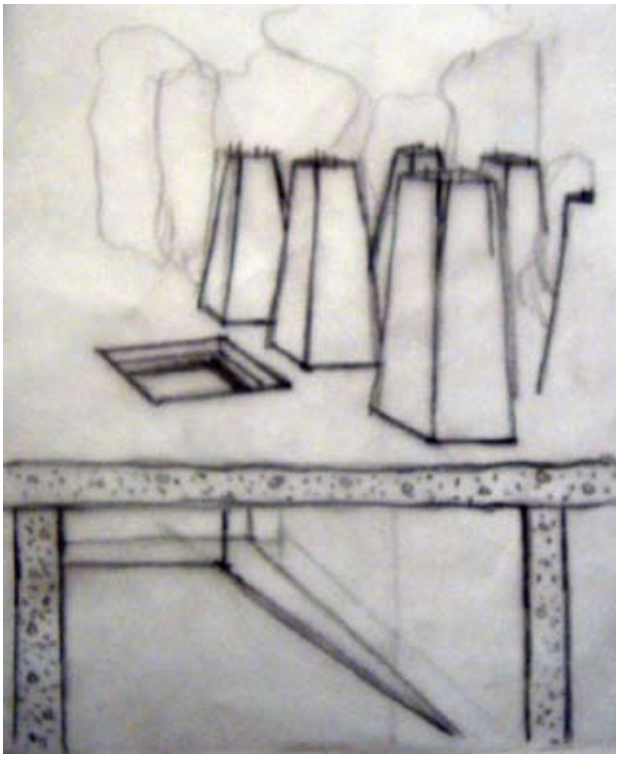


Figure 5.12 Large storage rooms are located underneath the surface platform. [March 2009]

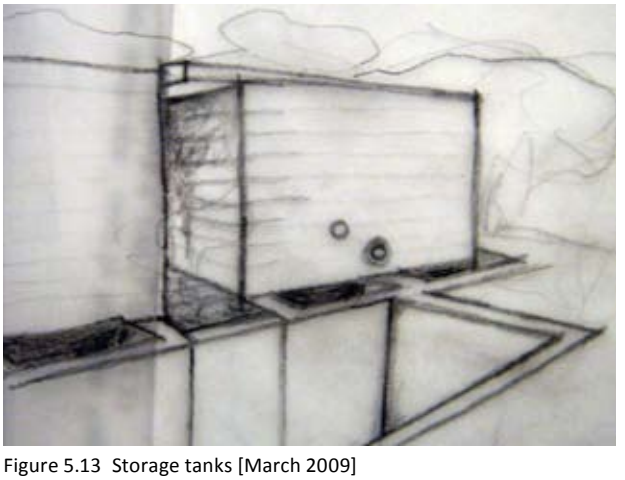


Figure 5.13 Storage tanks [March 2009]

Remnants of the original storage tanks that are approximately 3m below the natural ground surface have filled with rainwater and other scraps of ruined elements accumulated over time. It is presumed that these tanks were originally used to cool the pumped water down, as the temperatures below ground are much cooler than the outside surface temperatures.

Figure 5.14 Open storage tanks filled with dead leaves [August 2009]

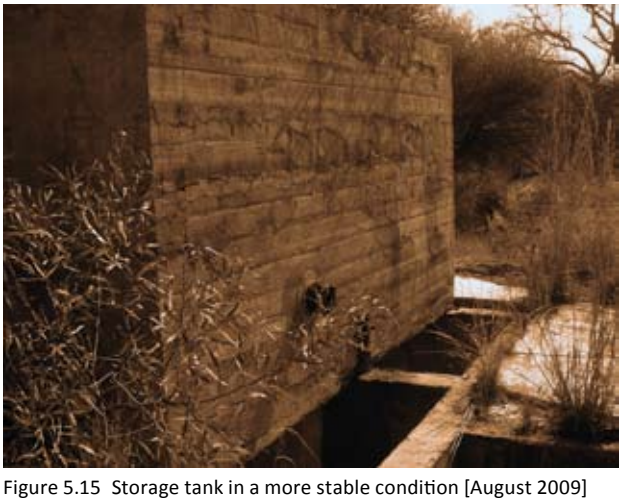


Figure 5.15 Storage tank in a more stable condition [August 2009]

5.2 Invisible cities

The city of Sophronia is made up of two half cities. In one there is the great roller-coaster with its steel humps, the carousel with its chain spokes, the Ferris wheel of spinning cages, the death-ride with crouching motor-cyclists, the big top with the clump of trapezes hanging in the middle. The other half-city is of stone and marble and cement, with the bank, the factories, the palaces, the slaughterhouse, the school, and all the rest. One of the half-cities is permanent, the other is temporary, and when the period of sojourn is over, they uproot it, dismantle it, and take it off, transplanting it to the vacant lots of another half-city. **[Groak, 1992:59]**

Capitalist development and the persistent search for profit inevitably produce spaces of ruination and dereliction. These industrial ruins represent the rise and fall of an economic era. As often happens with these industrial landscapes, memories fade and these sites are regarded as 'scars on the landscape' or 'wastelands', conceptions stripping the structure of its value in terms of its possible future uses.

During this time of economic volatility and environmental alarm, it is perhaps time, as Edensor states, 'to contest the notion that ruins are spaces of waste, that contain nothing, or nothing of value, and that they are saturated with negativity as spaces of danger, delinquency, ugliness and disorder' [Edensor, 2005:7].

Figure 5.16 Small stairs leading into open storage tank [March 2009]

Figure 5.17 Soda ash residue with left over bricks on southern edge of factory structures [August 2009]

Figure 5.18 Concrete floor with corroded pipe elements protruding [August 2009]

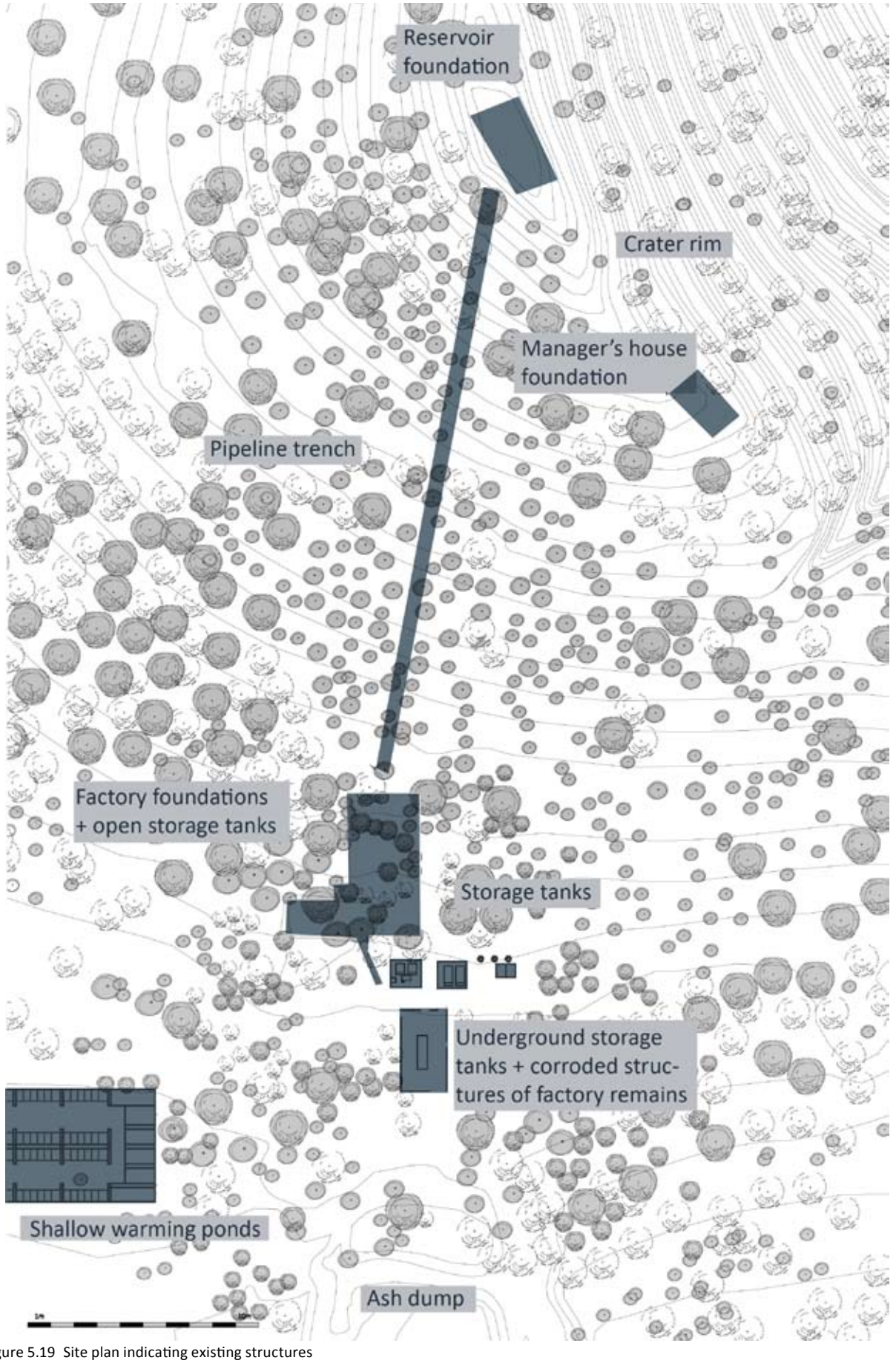


Figure 5.19 Site plan indicating existing structures

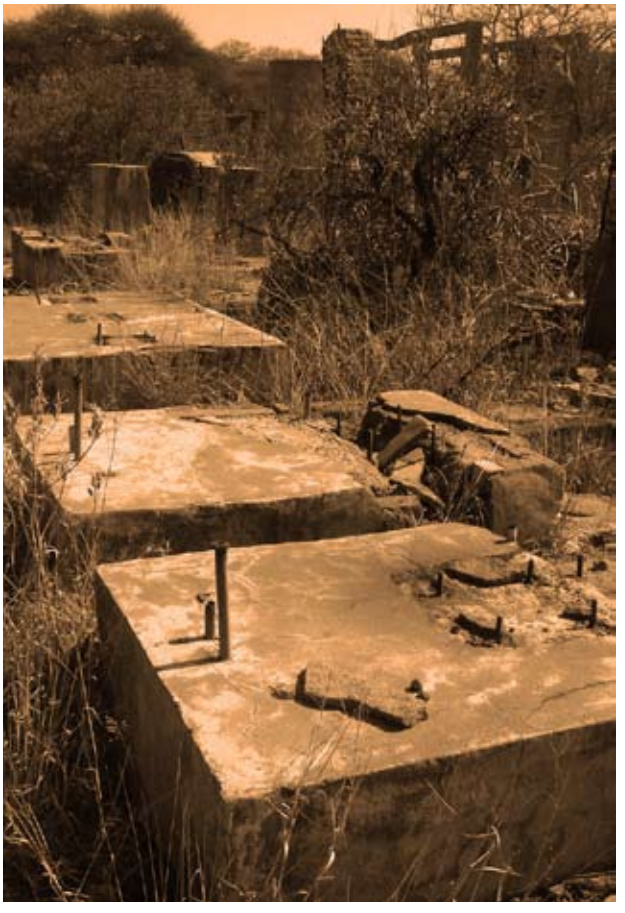


Figure 5.20 Possible foundations of corrugated structures [August 2009]

Figure 5.21 Reinforced concrete elements [March 2009]

Figure 5.22 Reinforced concrete storage tanks [March 2009]

Figure 5.23 Reinforced concrete column structure [March 2009]

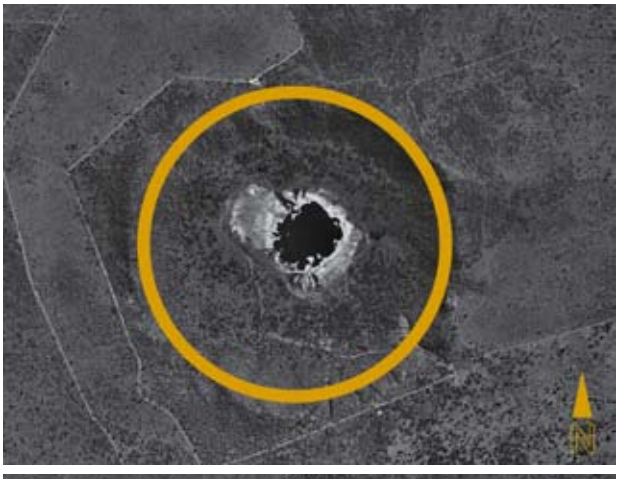
Figure 5.24 Foundations of historic warming ponds [August 2009]

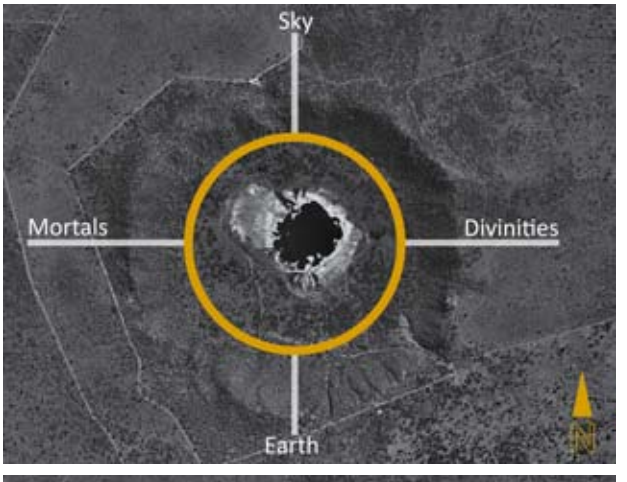
06 DESIGN DEVELOPMENT

The purpose of the design development is to illustrate the design process and thinking behind major decisions as clear as possible.

The design process consisted of a vast amount of decisions and potential resolutions that were argued out throughout the course of the year. As Wittgenstein points out '[t]oday the difference between a good and a poor architect is that the poor architect succumbs to every temptation and the good one resists it' [Perkins, 1995:220]

6.1 Concept development





The design concept was driven by the site analysis, and was primarily influenced by Christian Norberg-Schulz's theories concerning the concept of dwelling. He refers to architecture as the structure within which man can dwell on earth underneath the sky.

The crater was regarded as a centre by the surrounding inhabitants. According to Norberg-Schulz, human life relates to centres where actions of primary importance take place.

The path complements the centre. The crater becomes the centrifugal meeting place of the path, of earth and sky, and of mortals and divinities [To this day, TMC has a strong spiritual community following a variety of religious beliefs].

The TMC has a rich history. The memory of the site and its related narration is fading as time passes and limited information is available. This thesis proposal suggests that the site represents a memory that can be translated into a memorial. The identified needs resulted in a programme consisting of a visitor centre or interpretation centre and viewing access to the crater. The design was developed around these ideas, focusing mainly on the interpretation centre located in the area of the historic salt and soda factory.

Figure 6.01 Aerial photograph of the site, taken in 2007. [Adapted from photograph, Chief Directorate: Land Surveys and Mapping]

Figure 6.02 The selected site consists of the crater and surrounding area

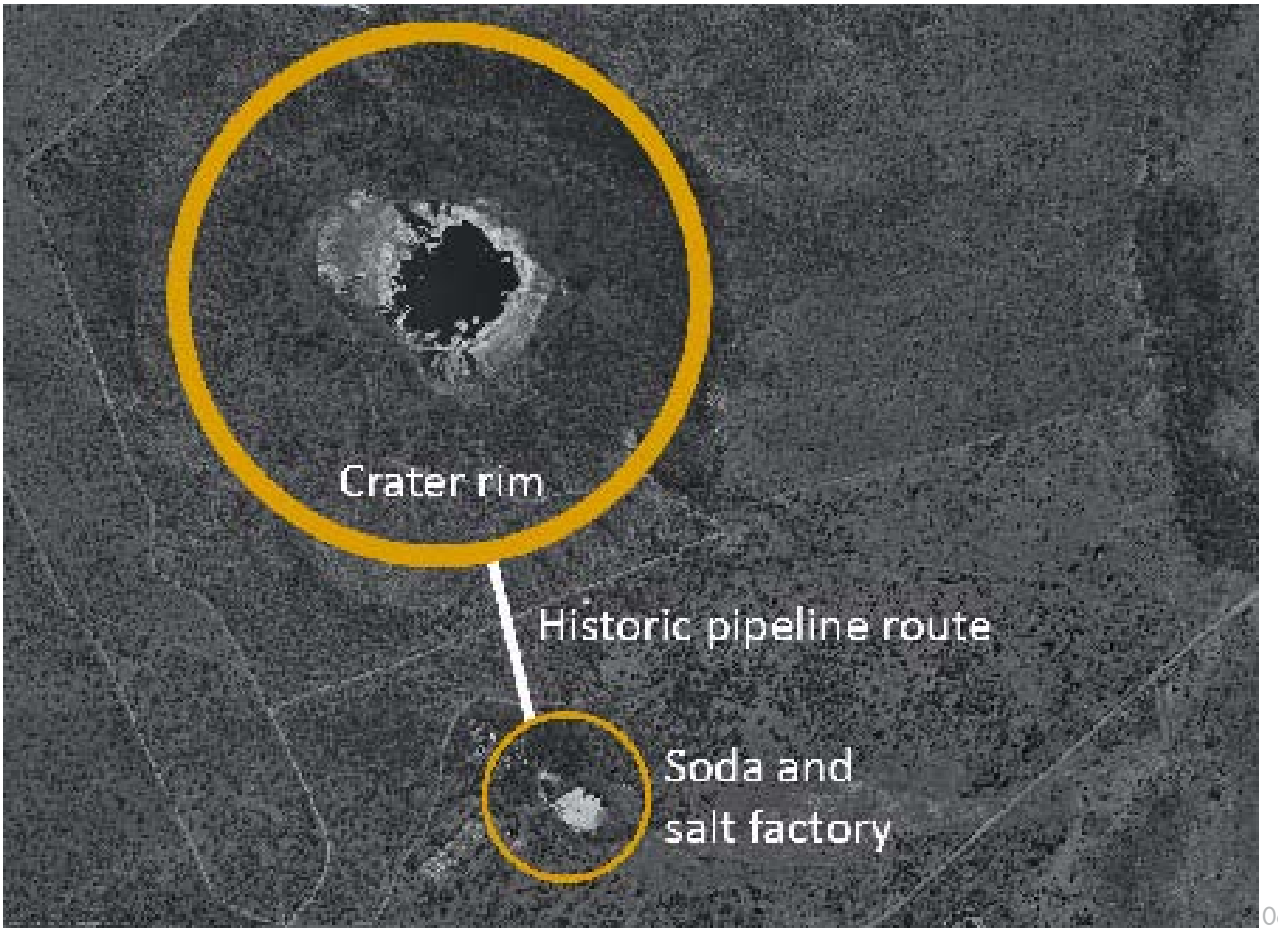
Figure 6.03 The crater as the centre with the relating abstract paths as identified by Christian Norberg-Schulz [Norberg-Schulz, 1985:23]

Figure 6.04 The site represents a collective memory

The general aim of the design is to facilitate the experience of the site and manifest its memory.

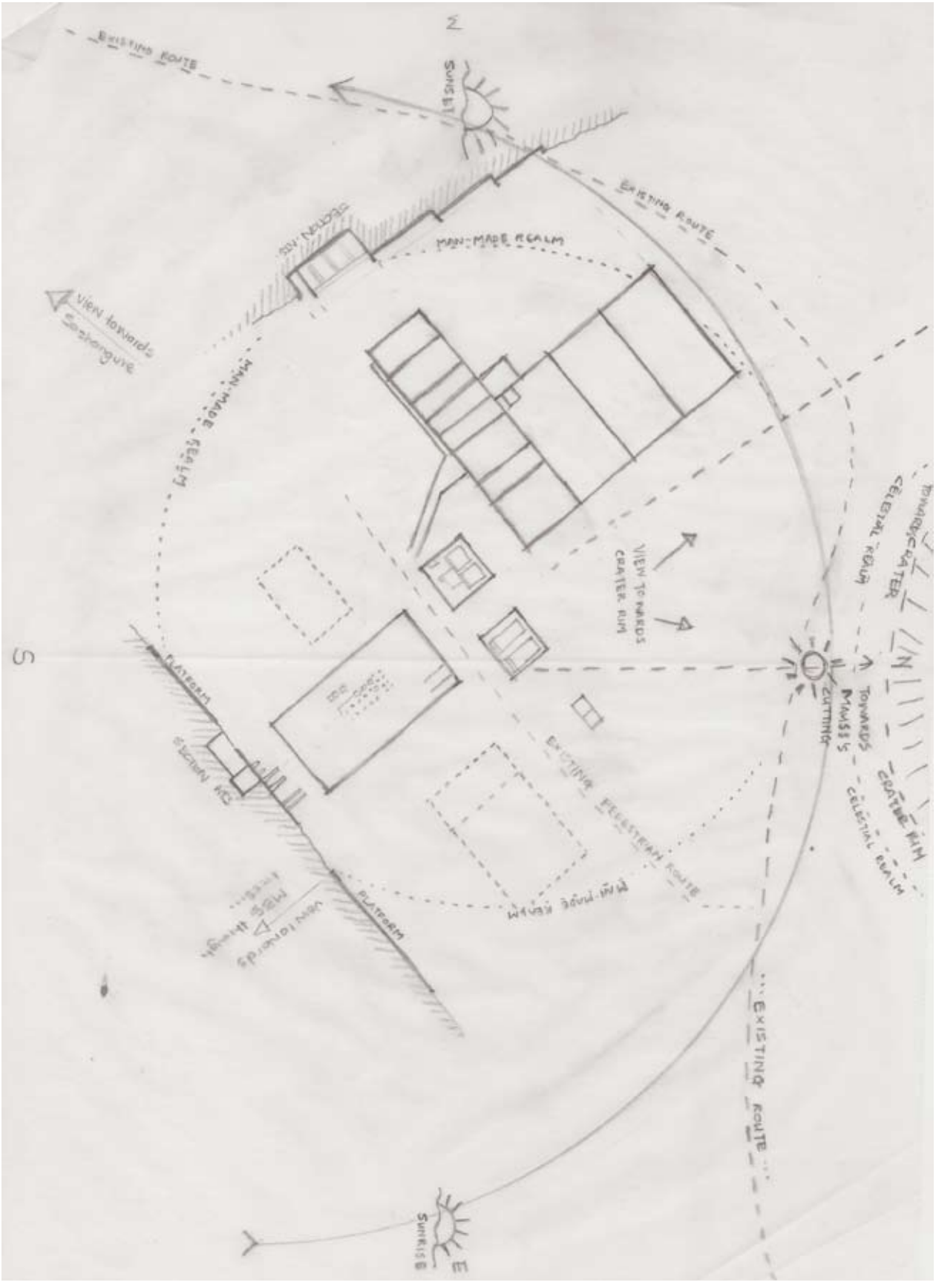
Figure 6.05 The collective memory can be translated into a memorial

Figure 6.06 The identified focus area of the project that is located in the historic salt and soda factory ruins



The site was analysed in terms of orientation, existing structures, landscape and existing vehicular as well as pedestrian routes.

Figure 6.07 Site analysis [March 2009]



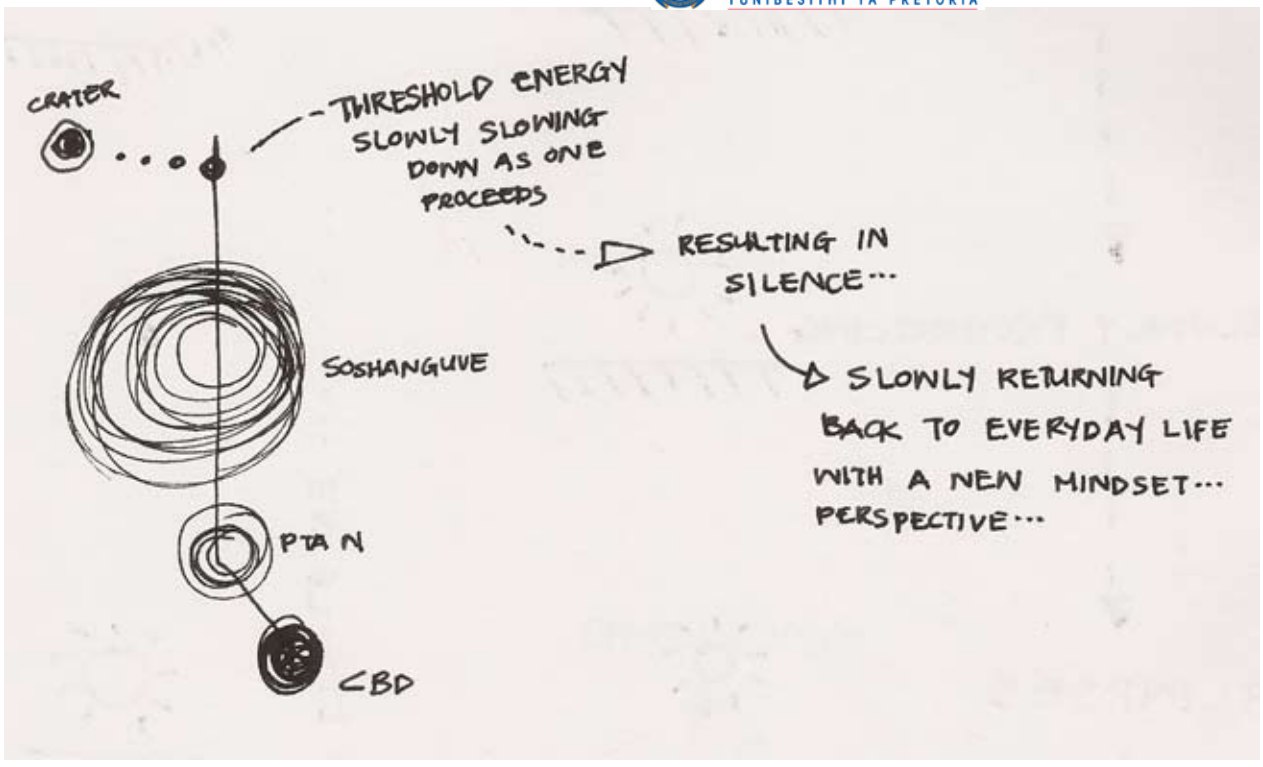
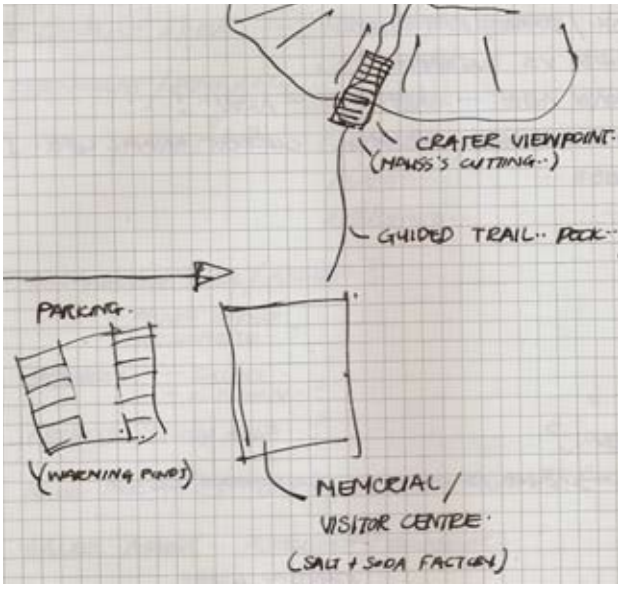


Figure 6.08 Conceptual site analysis indicating energy levels ranging from the Pretoria CBD towards the centre of the TMC, the Crater. [March 2009]

The site was initially analysed with the strengths and weaknesses in mind to identify the potential program that would be most appropriate for the selected site. The site is a nature reserve, 40km from Pretoria CBD, bordering the Soshanguve settlement. The nature of the reserve is calm and relaxed in contrast with the vibrant life in the CBD and along the M35 passing through Soshanguve on the way to TMC.

The concept of a retreat was considered, but exchanged for the most desperate need of the site - an appropriate visitor centre.



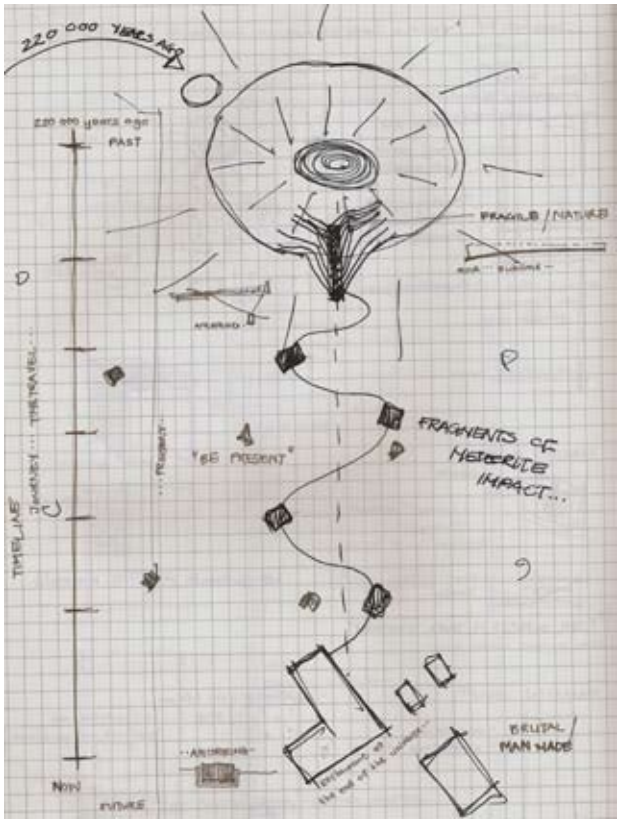
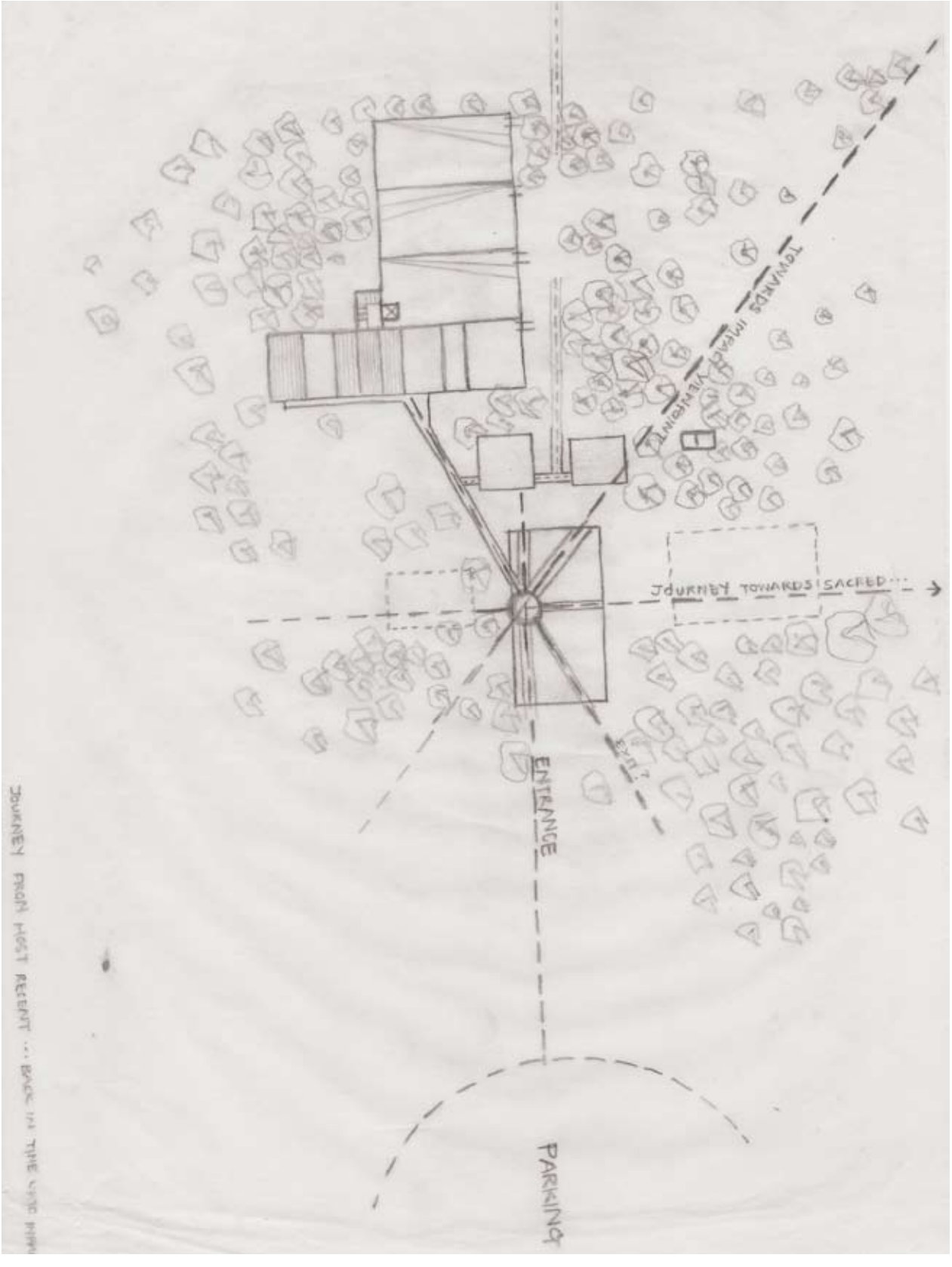


Figure 6.10 Conceptual site layout plan [June 2009]

Figure 6.09 Conceptual site layout plan [April 2009]

The salt and soda factory, with its enchanting ruins was selected as the site for the design proposal. The structures and surrounding routes were identified and analysed to inform an appropriate intervention.

Figure 6.11 Initial concept plan [April 2009]



The radial nature of light in conjunction with the fragmented impact of the meteorite was initial inspiration for the form and route development of the design proposal in conjunction with the existing conditions and historic layer.

Figure 6.12 Conceptual site layout plan [May 2009]

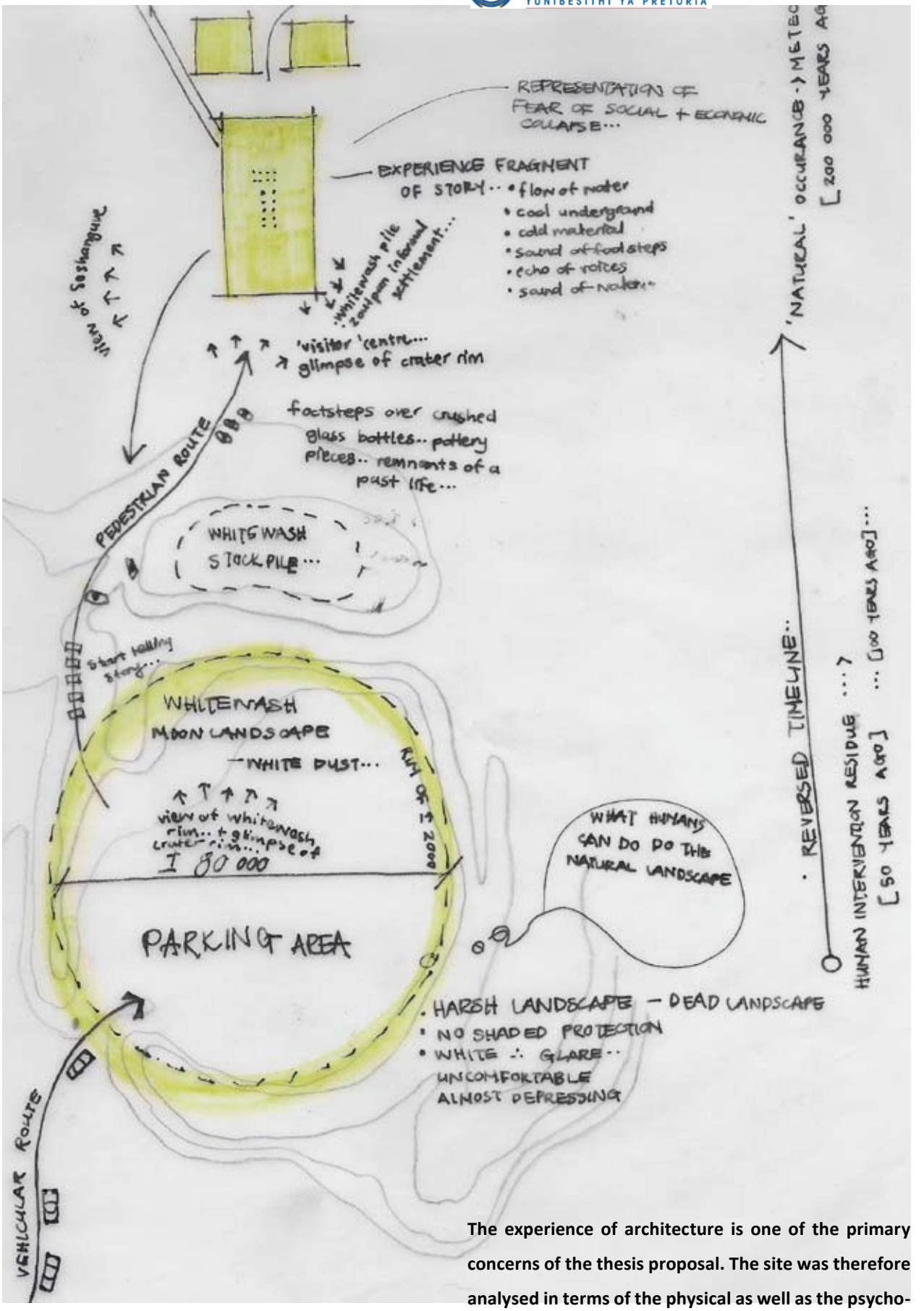


Figure 6.13 Conceptual site layout plan [August 2009]

The experience of architecture is one of the primary concerns of the thesis proposal. The site was therefore analysed in terms of the physical as well as the psychological elements.

6.2 On seeing and being seen

In the article, To see and be seen [1995:114-117] Kengo Kuma states specifically in relation to the architecture of observatories, that 'it is the sight line rather than the function, which truly controls modern society and life'. The sight line has a tremendous influence on space as it transcends, surpasses and dominates all functions of place. The renovation is therefore proposed to redirect the sight line. In general it is accepted that a building is perceived as an object, and is therefore seen as an independent form. As Kuma states, 'by reversing the sight line, we can seize the moment and escape the spell of the object'. Kuma highlights the fact that although observatories are facilities to enable observation, they often tend to become something to be seen.

The aim of the project is therefore to incorporate the architecture into the site where the structure consists of moments of either resisting or merging with the ground, becoming part of the site, and seemingly being invisible to the sight line of the approaching visitor. Rather than making a statement as a building, the building merely becomes a facilitator for the observer to take part in the act of viewing and observing the site.

Figure 6.14 Underground structure with opening for natural sunlight [March 2009]

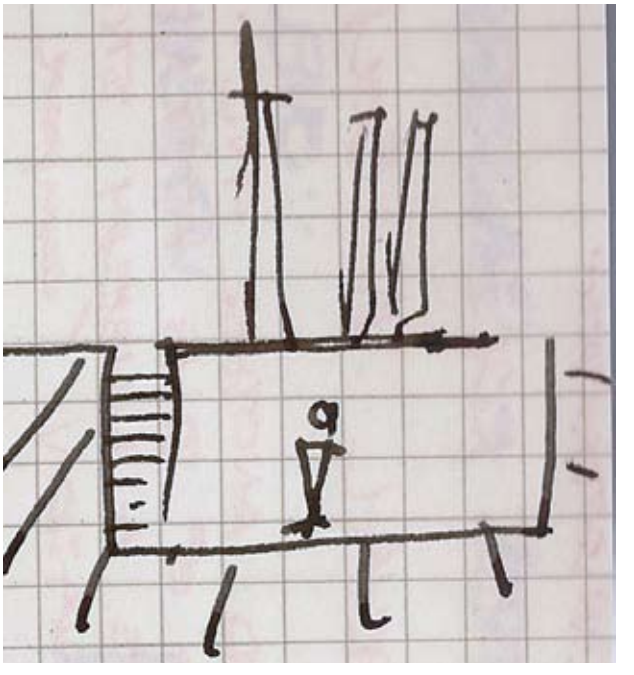


Figure 6.15 Underground exhibition area within existing salt and soda mine ruins [April 2009]

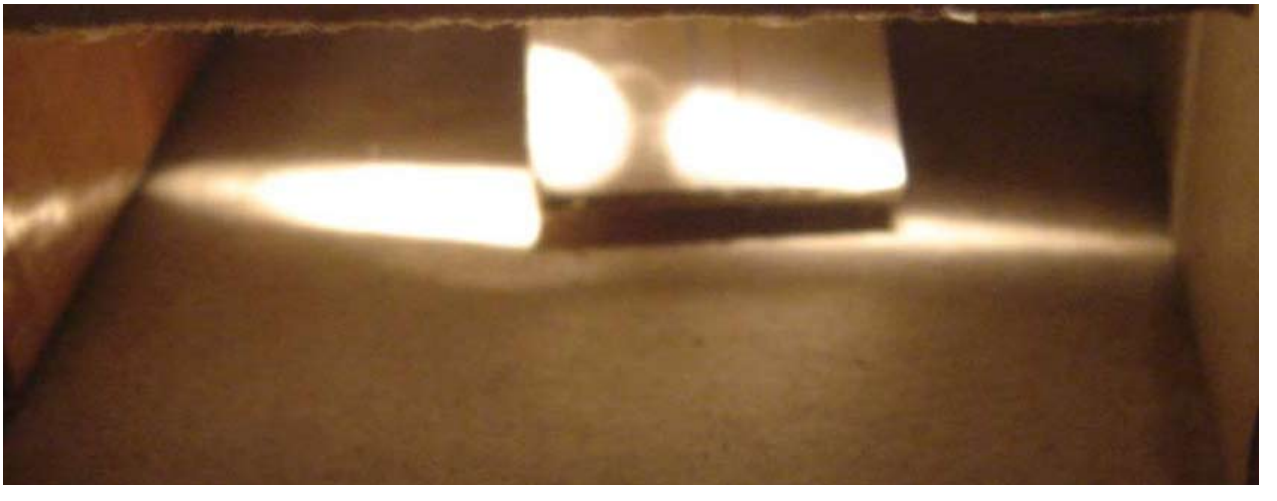


Figure 6.16 An experiment with the effect of light and atmosphere in submerged structures [July 2009]

6.3 Defining space

The design is semi-submerged within the surrounding landscape, ranging between various depths as levels change throughout the design. The depressed planes are designed in conjunction with the existing sub-merged levels of the historic factory.

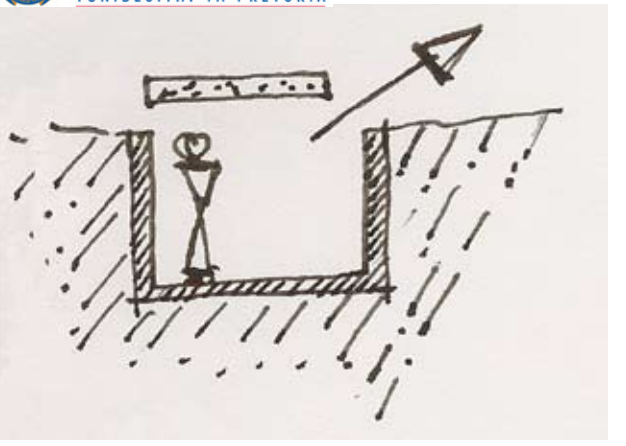


Figure 6.17 Underground structure [March 2009]

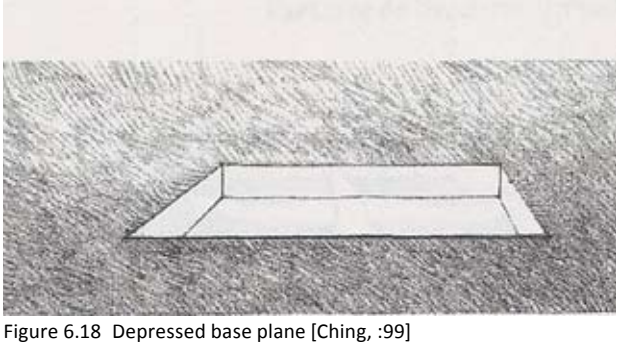


Figure 6.18 Depressed base plane [Ching, :99]

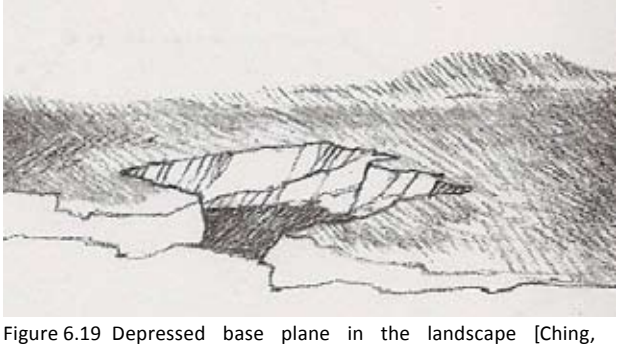


Figure 6.19 Depressed base plane in the landscape [Ching, 1996:99]

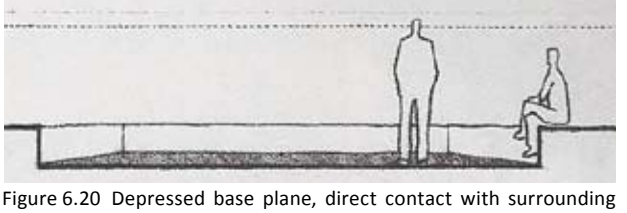


Figure 6.20 Depressed base plane, direct contact with surrounding landscape remain [Ching, 1996:109]

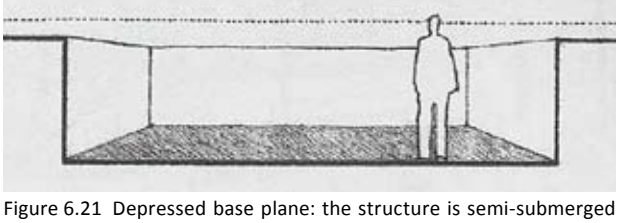


Figure 6.21 Depressed base plane: the structure is semi-submerged in the ground, the degree of exposure to the surrounding landscape becomes limited [Ching, 1996:109]

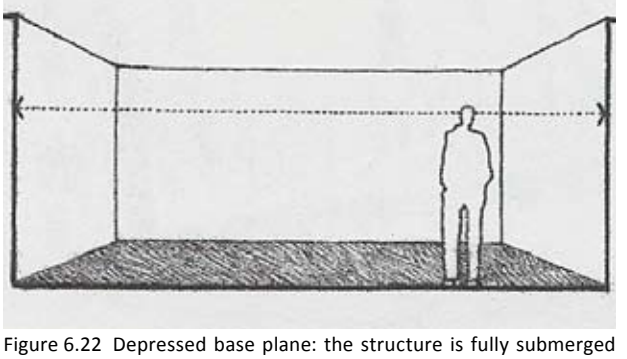


Figure 6.22 Depressed base plane: the structure is fully submerged in the ground, isolating the interior from the surrounding landscape [Ching, 1996:109]

Figure 6.23 Existing storage tank with a depth of approximately 3m [August 2009]

6.4 Atmosphere

History is experienced through atmosphere. The experience of time is exaggerated in the design as the existing ruins are left to decay over time. Weather and natural elements are received rather than resisted by structures old and new. The character of the design allows rain, wind and sunshine to permeate the architecture. The abstract experience of architecture is emphasised as part of the landscape when shafts of light enter the space and shifting shadows animate the volumes, while water marks on the concrete surface planes draw attention to nature's permanent effect on the structure as it becomes merely a layer blending into the landscape as time passes.

Figure 6.25 Experiment with light and atmosphere [July 2009]

Figure 6.26 Ruins decaying over time

Figure 6.27 Texture of decaying structures

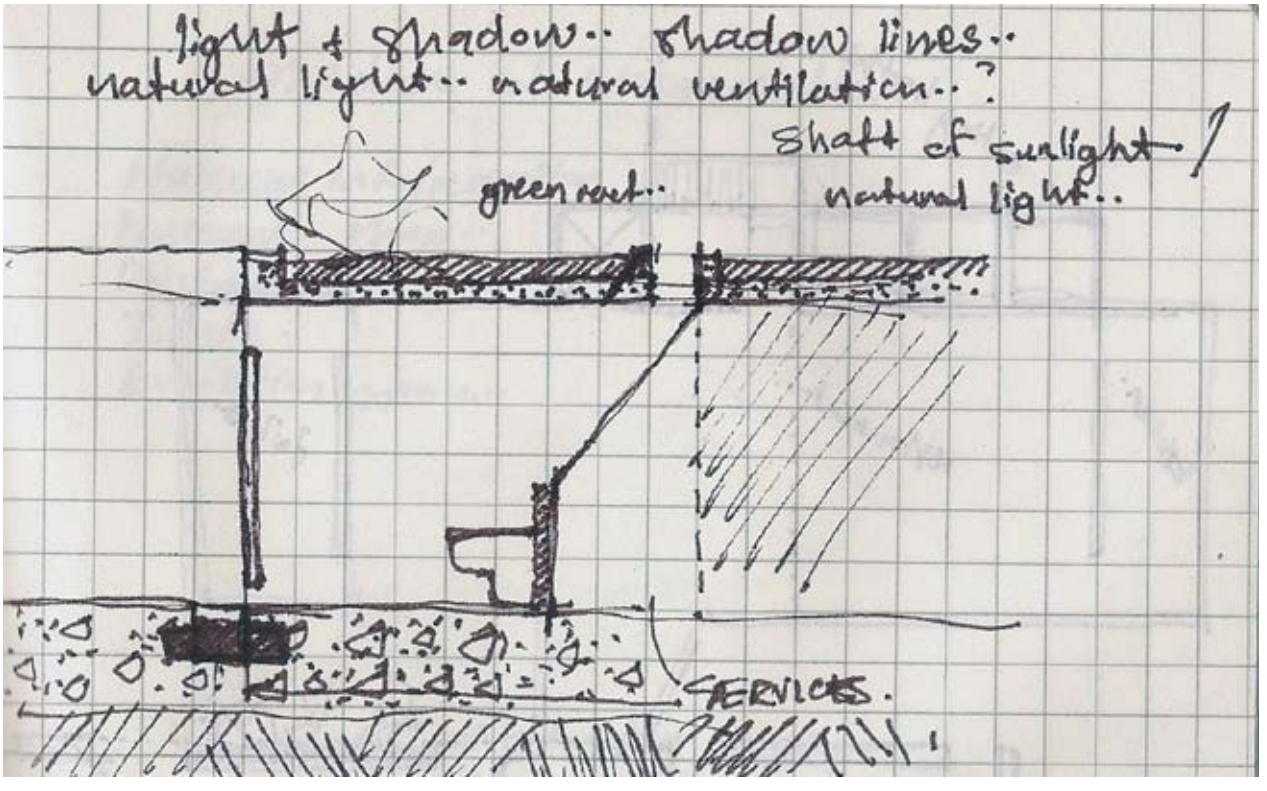


Figure 6.24 Concept sketch, indicating opening for natural light and ventilation, service shaft and green roof [June 2009]

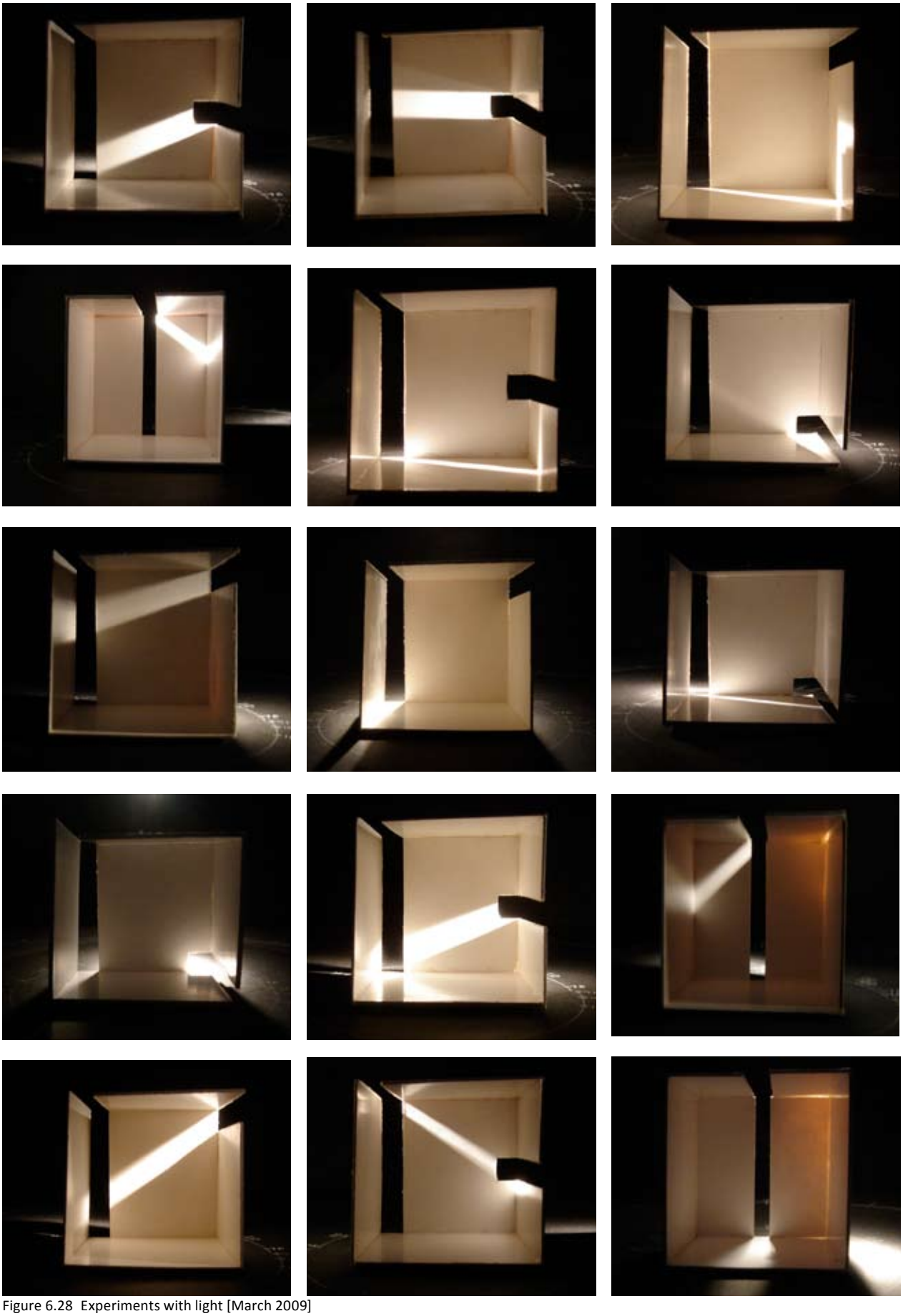


Figure 6.28 Experiments with light [March 2009]

6.5 Natural light

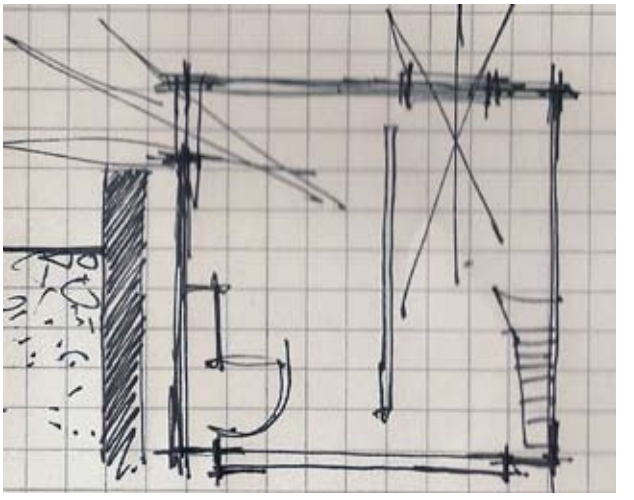


Figure 6.29 Natural light as design element [July 2009]

Louis Kahn says the following about light:

'Inspiration is the feeling of beginning at the threshold where Silence and Light meet. Silence, the unmeasurable, desire to be, desire to express, the source of new need, meets Light, the measurable, giver of all presence, by will, by law, the measure of things already made, at a threshold which is inspiration, the sanctuary of art, the Treasury of Shadow.' **[Lobell, 2000]**

The physical mediation between nature and architecture is achieved by vertical and horizontal openings through which the light penetrates. As employed by Aalto, openings are used primarily to let light in rather than frame views of the outside [Groak, 1992:217].

In some areas, the physical erosion of the existing structure is used to let light in. The dynamic behaviour of sunlight animates space and materials by bringing life from nature outside into the interior of the structure during the course of the day. Openings and incisions in the structure guide the effects of light, sight and spatial experience.

The development of the design was influenced by the following statements by Peter Zumthor:

[The] sensation of ...having the landscape flow into or through the rooms inside - the landscape with all its light and shadows **[Zumthor, 2006:92].**

[The] light that meets the earth from afar, the untold numbers of bodies, structures, materials, liquids, surfaces, colours and shapes that radiate in the light. The light that comes from outside the earth makes the air visible, I can see it **[Zumthor, 2006:89 - 90].**

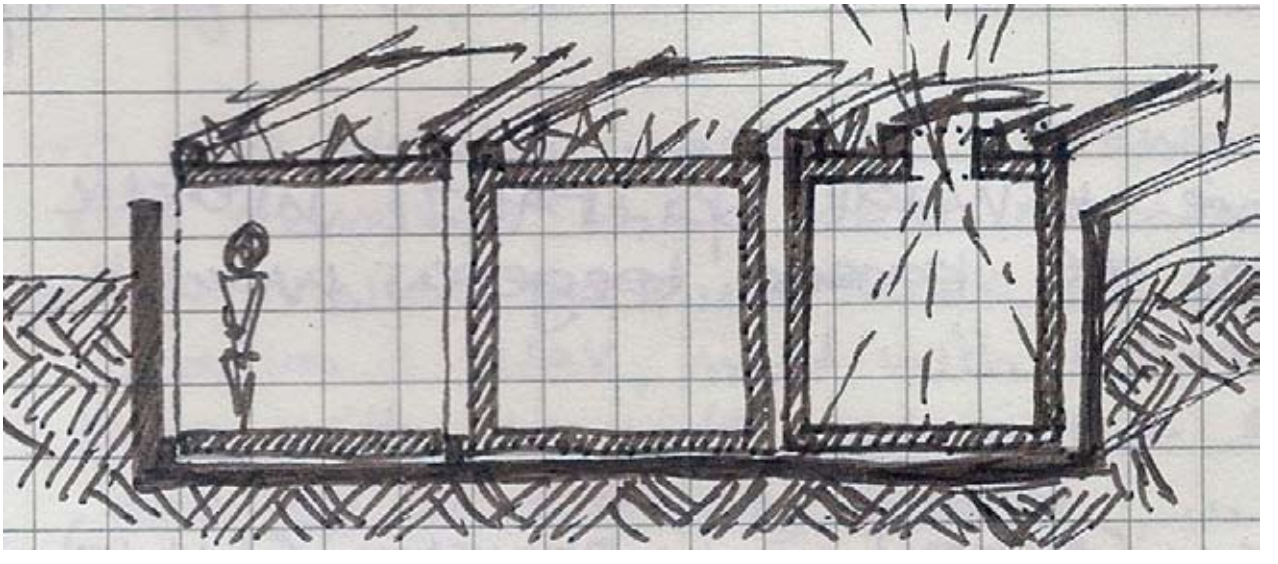


Figure 6.30 New structures within existing structure; green roofs; natural light as design element [August 2009]

6.6 Route

Peter Zumthor believes that '[a]rchitecture is the art of space and it is the art of time as well - between order and freedom, between following a path and discovering a path of our own, wandering, strolling, being seduced' [Zumthor, 2006:86-87].

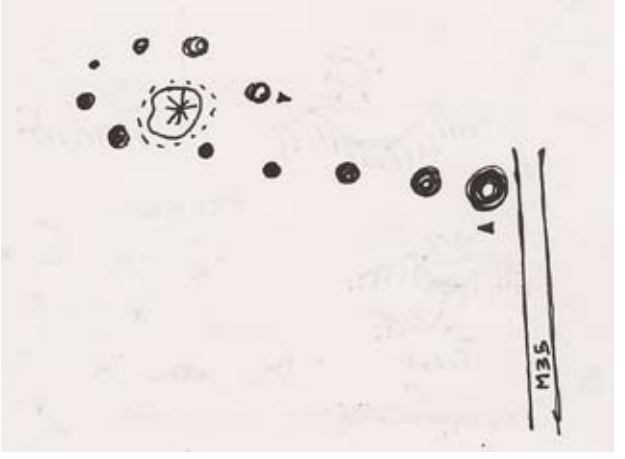


Figure 6.31 Conceptual layout of the route through the site, representing a succession of wanderings through which the visitor experiences the site. [March 2009]

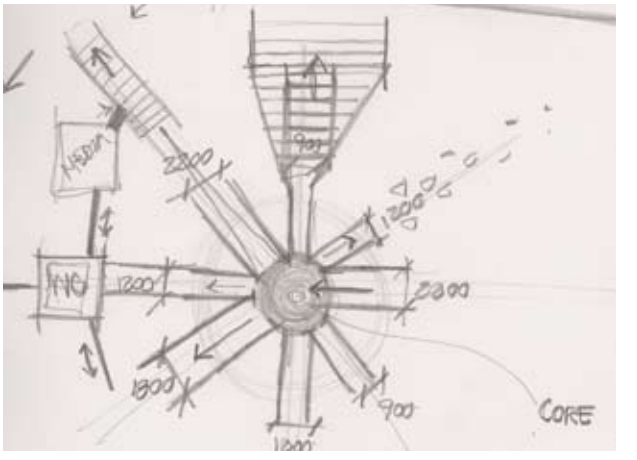


Figure 6.32 Initial concept plan with the existing structures as core of concept with radial routes dispersing in different directions with different exhibitions representing the radial effect of the meteor impact [March 2009]

According to Groak [1992:212] Alvar Aalto stated the following:

In modern architecture, where the rationality of the structural frame and the building masses threaten to dominate, there is often an architectural vacuum in the left-over portions of the site. It would be good if instead of filling this vacuum with decorative gardens the organic movement of people could be incorporated in the shaping of the site in order to create an intimate relationship between Man and Architecture.

Figure 6.33 Conceptual planning of the route with the horizontal axis as path [March 2009]

The initial approach to the design inherently started with the site, and the journey of the observer. Orientation, the landscape, existing structures and memory were the main conceptual elements and design drivers.

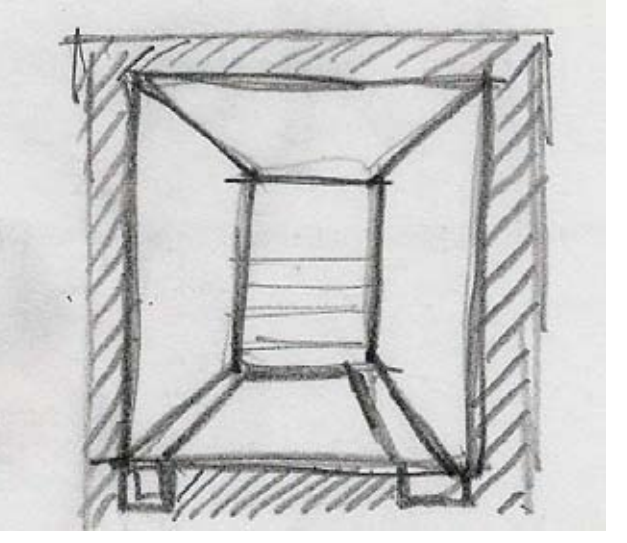


Figure 6.34 Enclosed route [March 2009]

The proposed accommodation schedule includes a reception area where visitors can pay the appropriate admission fee and receive relevant information regarding the site and the related exhibitions. The proposal consequently also provides exhibition space, administration offices, research facilities, a restaurant, shops and ablution facilities.

Circulation between the different functions of the centre was an important influence on the development of the design, as the success of the proposal depends on the activation of the route by means of circulation.

Various variations of the route and allocated functions were considered. Certain constraints such as the grouping of services, working in and around the existing structures, appropriate orientation of the structures to let optimal light in the interiors and access for the various user groups [including physically disabled persons] proved to be quite a challenge.

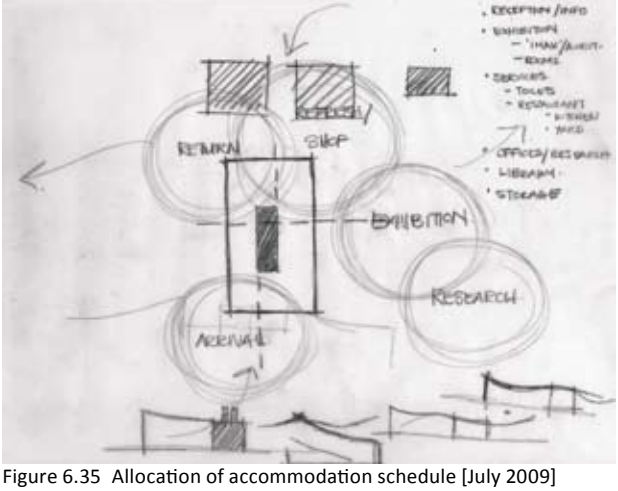


Figure 6.35 Allocation of accommodation schedule [July 2009]

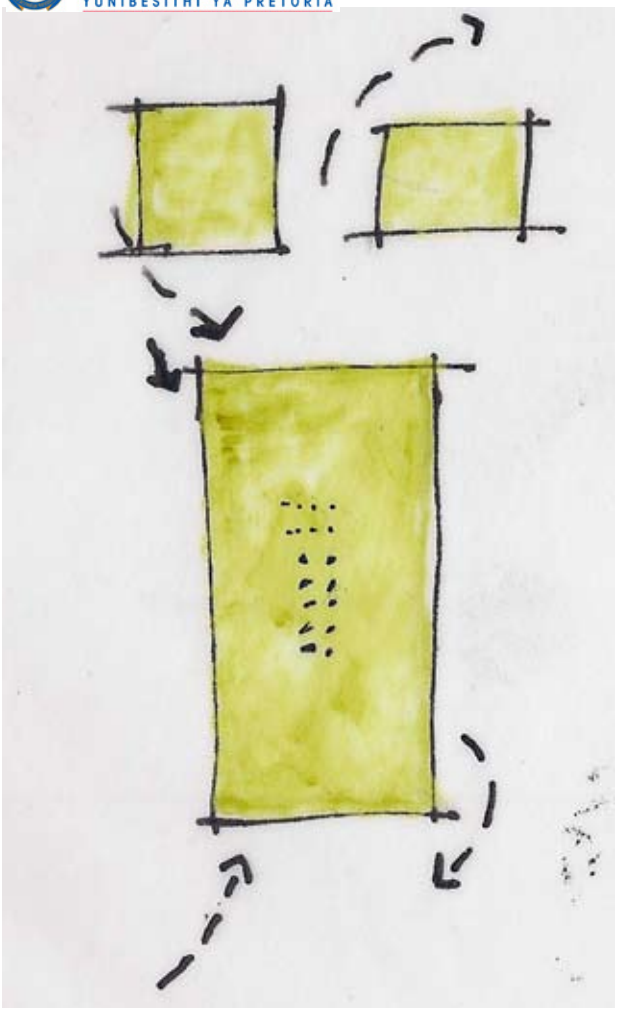


Figure 6.36 Circulation diagram [July 2009]

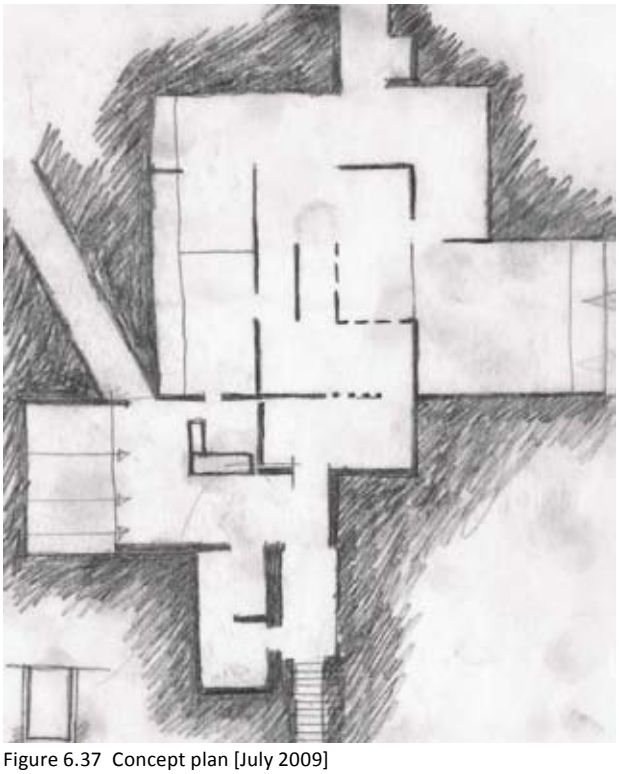


Figure 6.37 Concept plan [July 2009]

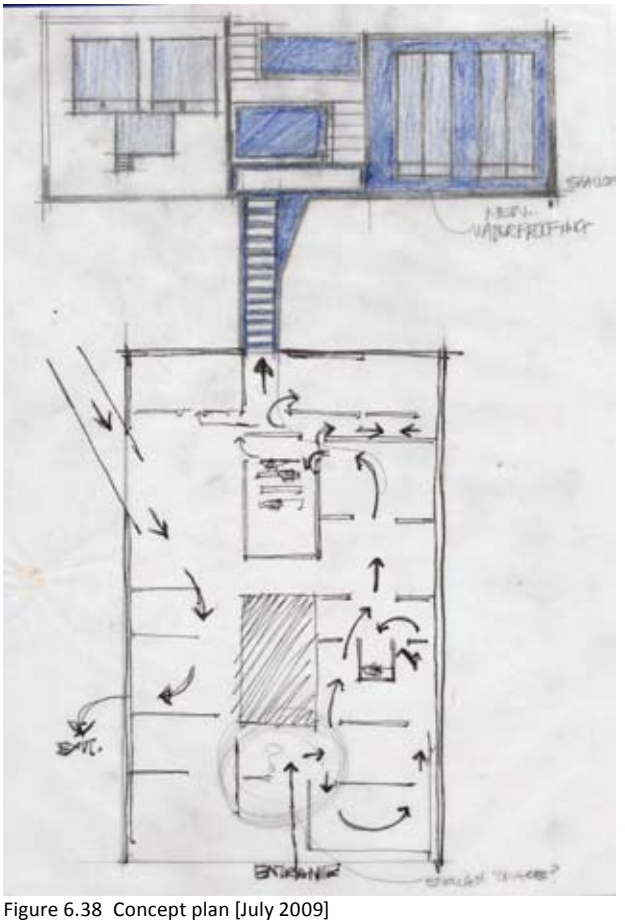


Figure 6.38 Concept plan [July 2009]

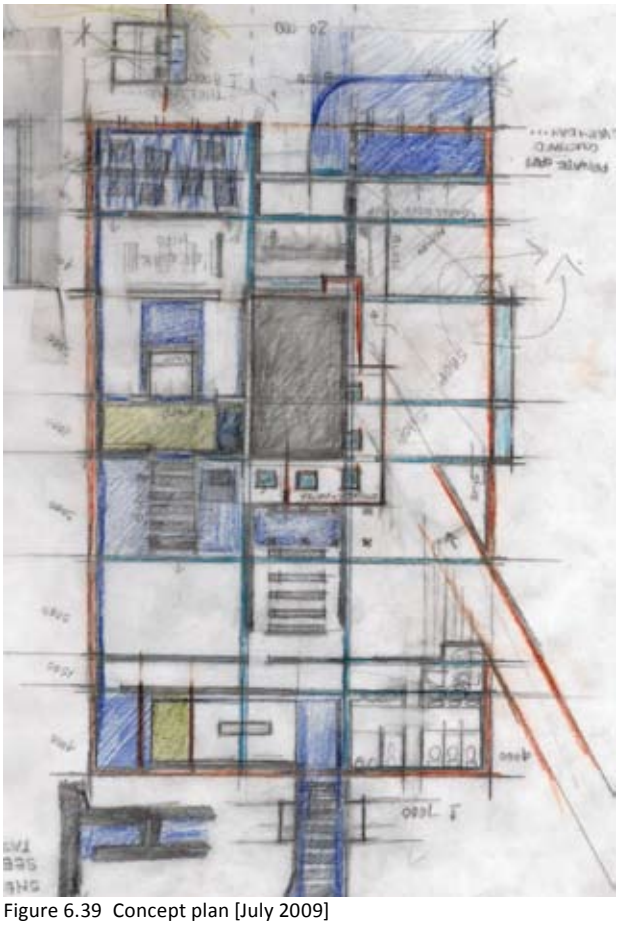


Figure 6.39 Concept plan [July 2009]

The concept in July focussed on a sensory stimulating route accompanied by a limited exhibition. The concept also proposed to fill the remaining existing structures with water. The problem with the concept was however that the surrounding trees and open nature of the structures would create a vast amount of problems with the volume of water that was proposed. The exhibition was also too small and too intense to portray a viable image of the site and its related history.

In August, extension to the left was proposed to alleviate the design of the previous mentioned concerns. Circulation however seemed unresolved as the route of movement was complex and awkward.

The next concept included a restaurant, research facilities and a large exhibition area. The design was however rough and the existing structures were not integrated properly. The large exhibition area dominated the scale and proportion of the design and did not seem appropriate for the site and nature of the existing structures.

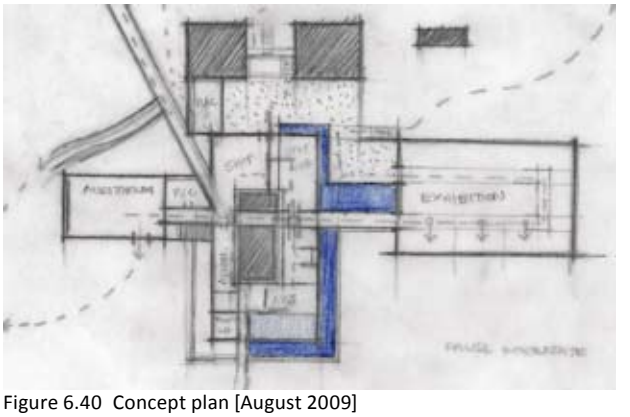


Figure 6.40 Concept plan [August 2009]

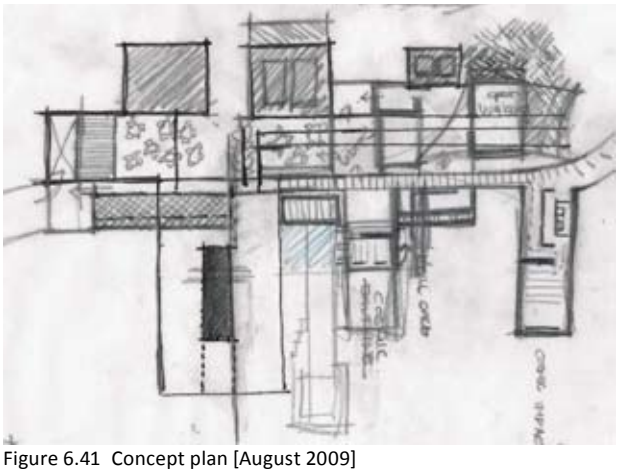


Figure 6.41 Concept plan [August 2009]

Another significant concept was to enable visitors to observe the activated research component of the site. The plan was consequently divided into sections to accommodate the different functions and their relations with each other. The plan was simplified, and a range of parti diagrams determined the design development.

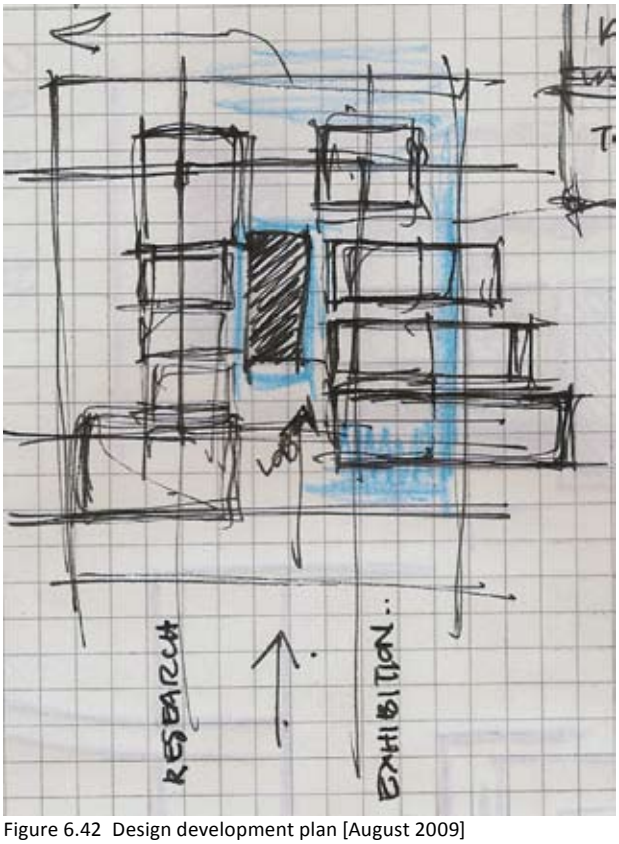


Figure 6.42 Design development plan [August 2009]

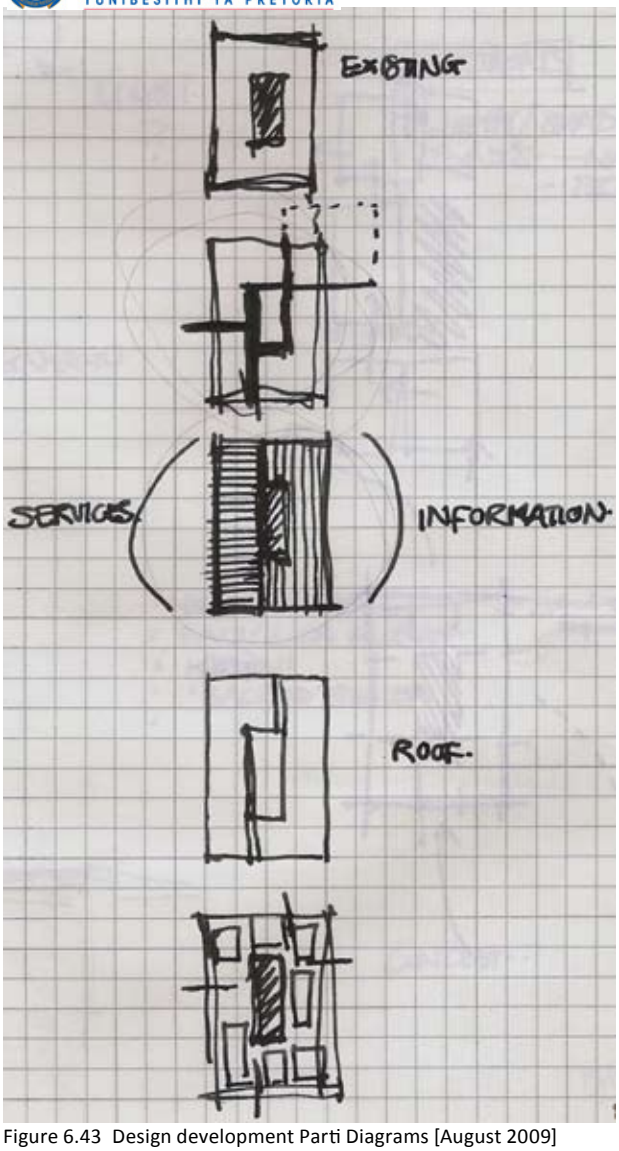


Figure 6.43 Design development Parti Diagrams [August 2009]

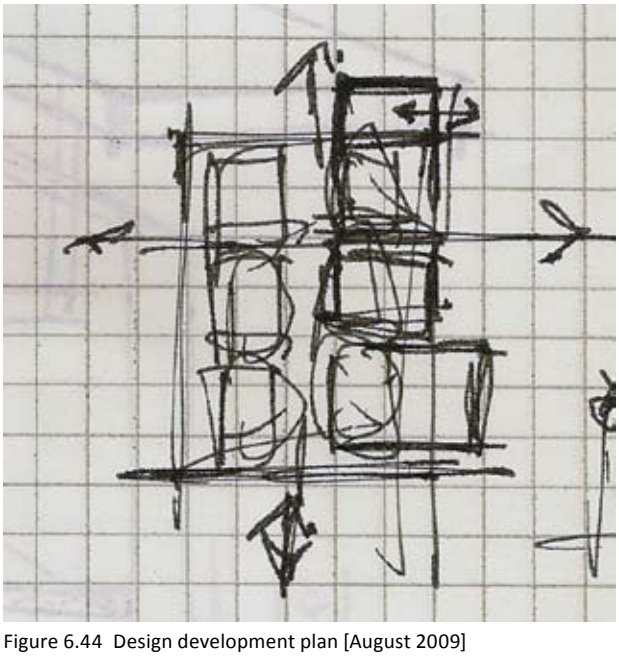


Figure 6.44 Design development plan [August 2009]

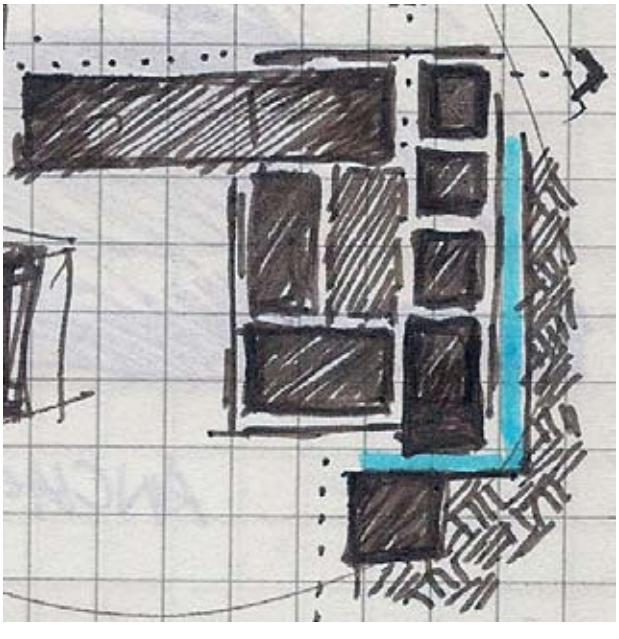


Figure 6.45 Design development plan [August 2009]

A series of interlocking spaces are created by the various configurations of wall elements in Mies van der Rohe's Country House in Brick. The linear elements disappear into the landscape.

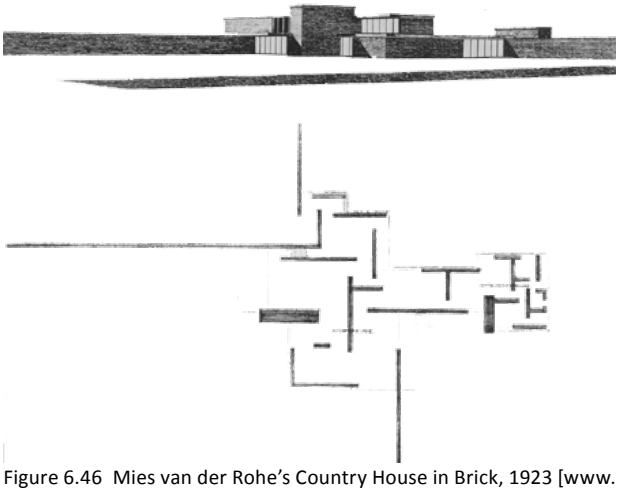


Figure 6.46 Mies van der Rohe's Country House in Brick, 1923 [www.aainter3.net/kevin/ accessed 01.09.2009]

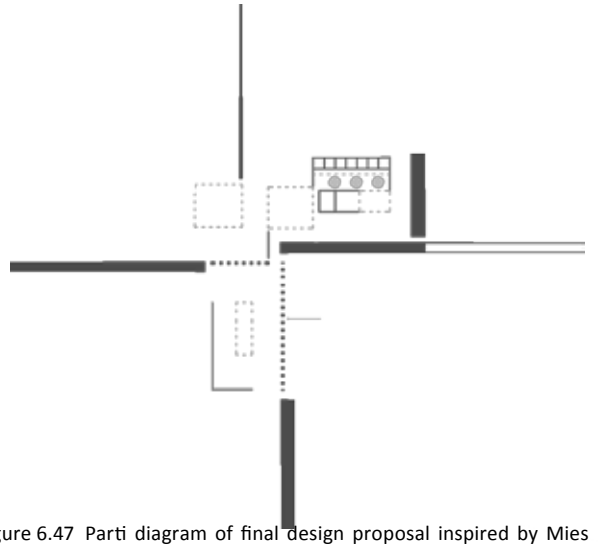


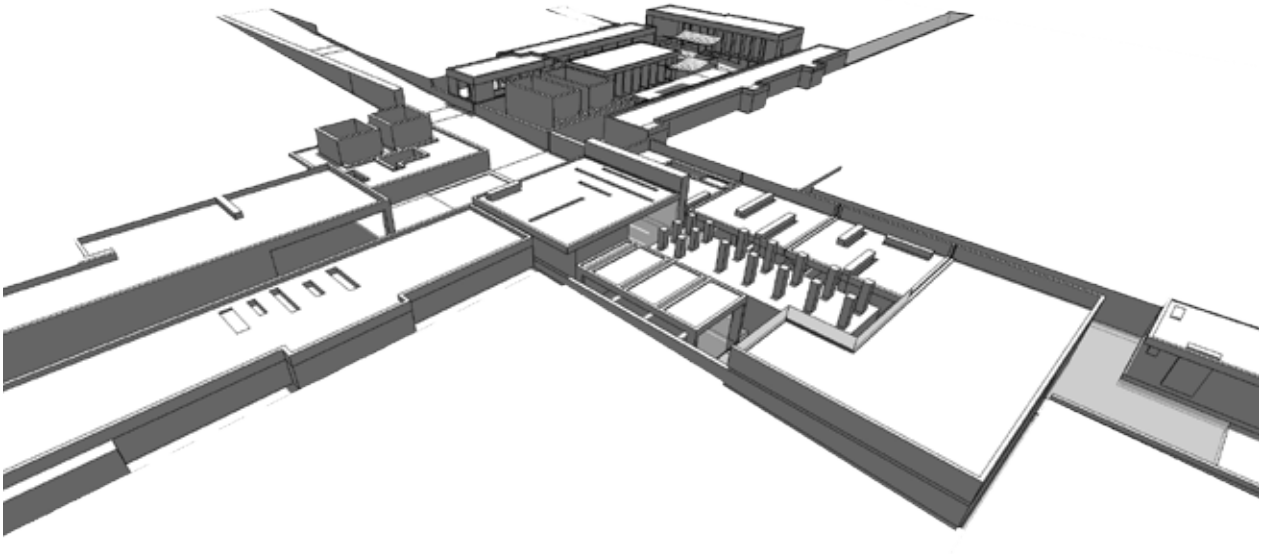
Figure 6.47 Parti diagram of final design proposal inspired by Mies van der Rohe's Country House in Brick [September 2009]

The architecture manifests itself as a layer integrated with the landscape. The route becomes a continuation of the ground as the proposed structure reveals itself as part of the journey through the site, informing the visitor along the way and enabling the observer to interpret the site through movement.

The structure is defined in space and time as the path of the sun is integrated in the spatial experience by means of sunlight penetrating the orchestrated openings. The visitor is guided along the physical route as spaces unfold that are modulated by means of openings, platforms, elements of water and slits of natural light. The relationship between man and nature is revealed by the juxtaposition of open courtyards and enclosed spaces, where the observer is exposed to the different elements of the environment such as sunlight contrasting with shade, and echoed sounds within the concrete structures versus sounds fading into the landscape.

All activities, such as those taking place in the research workshops, are revealed to the visitor along the route to enable a deeper understanding of the site.

Figure 6.48 View towards North over the interpretation centre



6.7 Accommodation Schedule

Reception		**Research**	
	Toilet Facilities	**55 m²**	**Workshop**	**65 m²**
	Reception office	**42 m²**	**Offices**	**66 m²**
	Reception platform	**63 m²**	**Store room**	**20 m²**
			Kitchenette	**35 m²**
Administration			**Library**	**54 m²**
	Reception	**32 m²**	**Lecture Hall**	**61 m²**
	Kitchenette	**9 m²**	**Toilets**	**39 m²**
	Toilet	**5 m²**		
	Boardroom	**45 m²**	**Commercial**	
	Office	**50 m²**	**Restaurant**	**148 m²**
			Kitchen	**83 m²**
Exhibition			**Kitchen yard**	**55 m²**
	Media room	**32 m²**	**Staff facilities**	**51 m²**
	Exhibition walk	**202 m²**	**Shop**	**86 m²**
	Drill core exhibition	**178 m²**	**Line shops**	**39 m²**
			Collective storage [shops]	**22 m²**
			Coffee shop	**98 m²**
			Toilets	**45 m²**

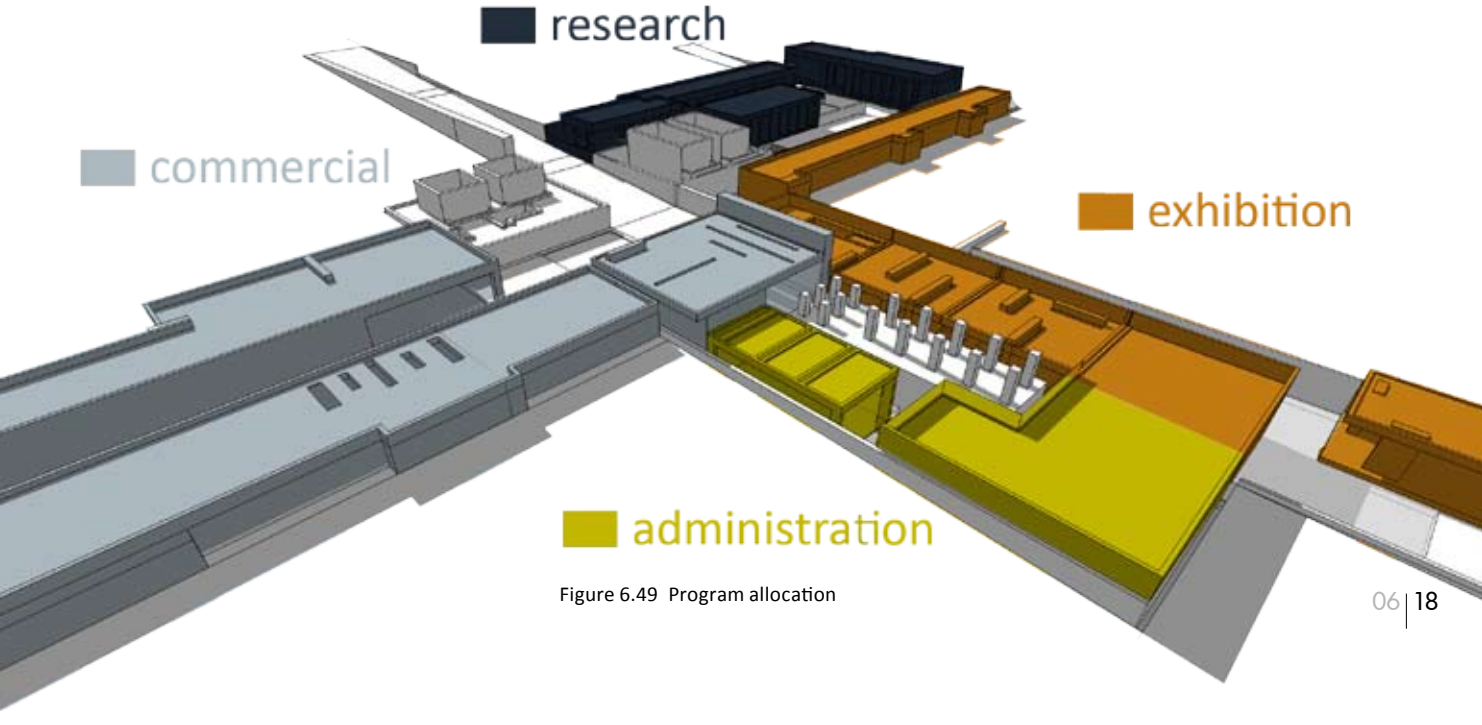


Figure 6.49 Program allocation

6.8 Circulation: Movement through space

The path of our movement can be conceived as the perceptual thread that links the spaces of a building, or any series of interior or exterior spaces **[Ching, 1996: 228].**

The structure is gradually revealed as the visitor moves along the path through the trees and past scenes of dumped soda ash that scar the landscape.

The route consists of a series of ramps, acting as a continuation of the surfaces of the landscape, and smoothly unfolding into the architecture, semi-submerged in the ground. The reception area located on this route is initially tucked into the landscape and is revealed as the visitor progresses towards the building where a covered platform opens up onto the building and a pond of water.

The new reinforced-concrete green roof and the concrete structure frame the entrance opening to the building in conjunction with part of the existing wall that acts as a containing element for the new intervention.

Once the visitor enters the building, cu-

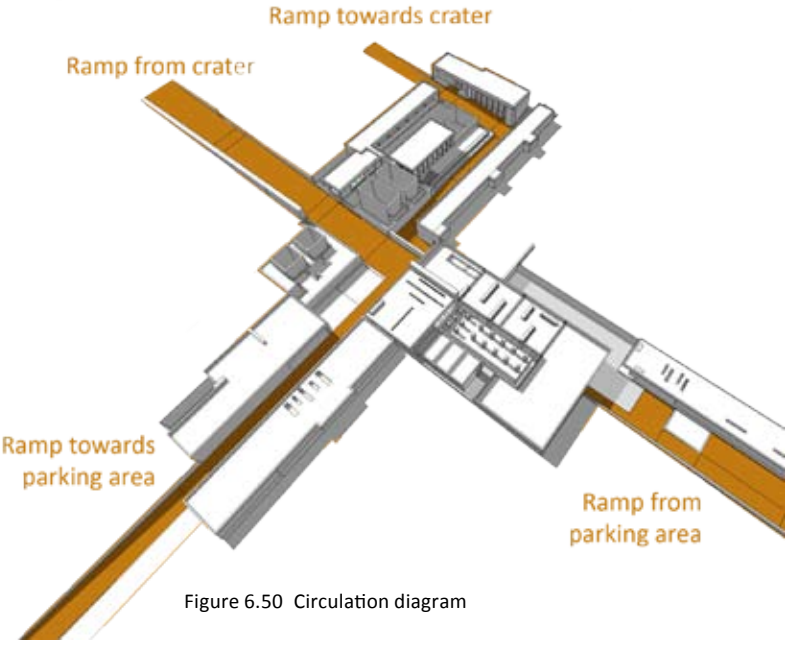


Figure 6.50 Circulation diagram

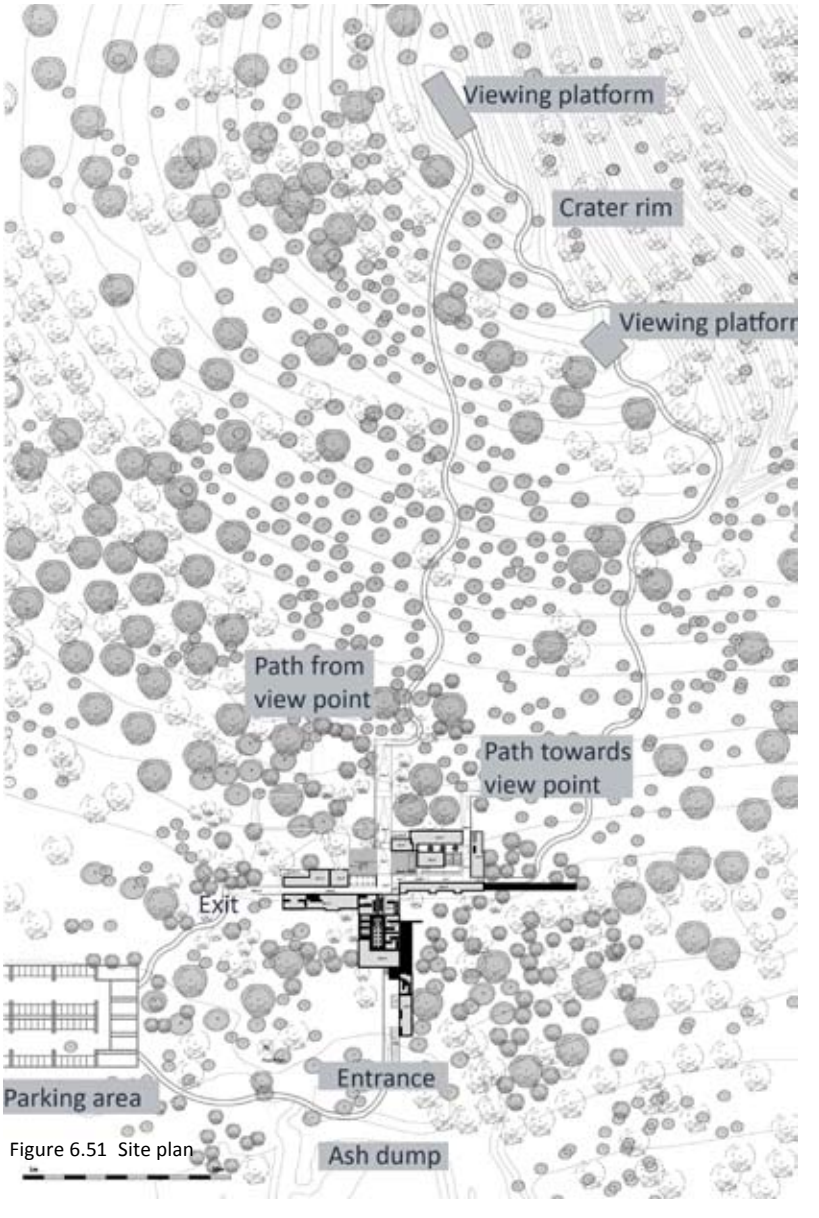


Figure 6.51 Site plan

riosity and light become the guiding elements. Water elements act as barriers where the viewer can see, but not access, the existing structures. Natural light penetrating the roof lights guides the visitor through the different spaces.

Along the first phase of the route, the visitor is continuously confronted with either planes upon which information is exhibited or planes of the existing structures representing memory.

Figure 6.53 View from entrance ramp, with the reception platform on the left towards the exhibition area

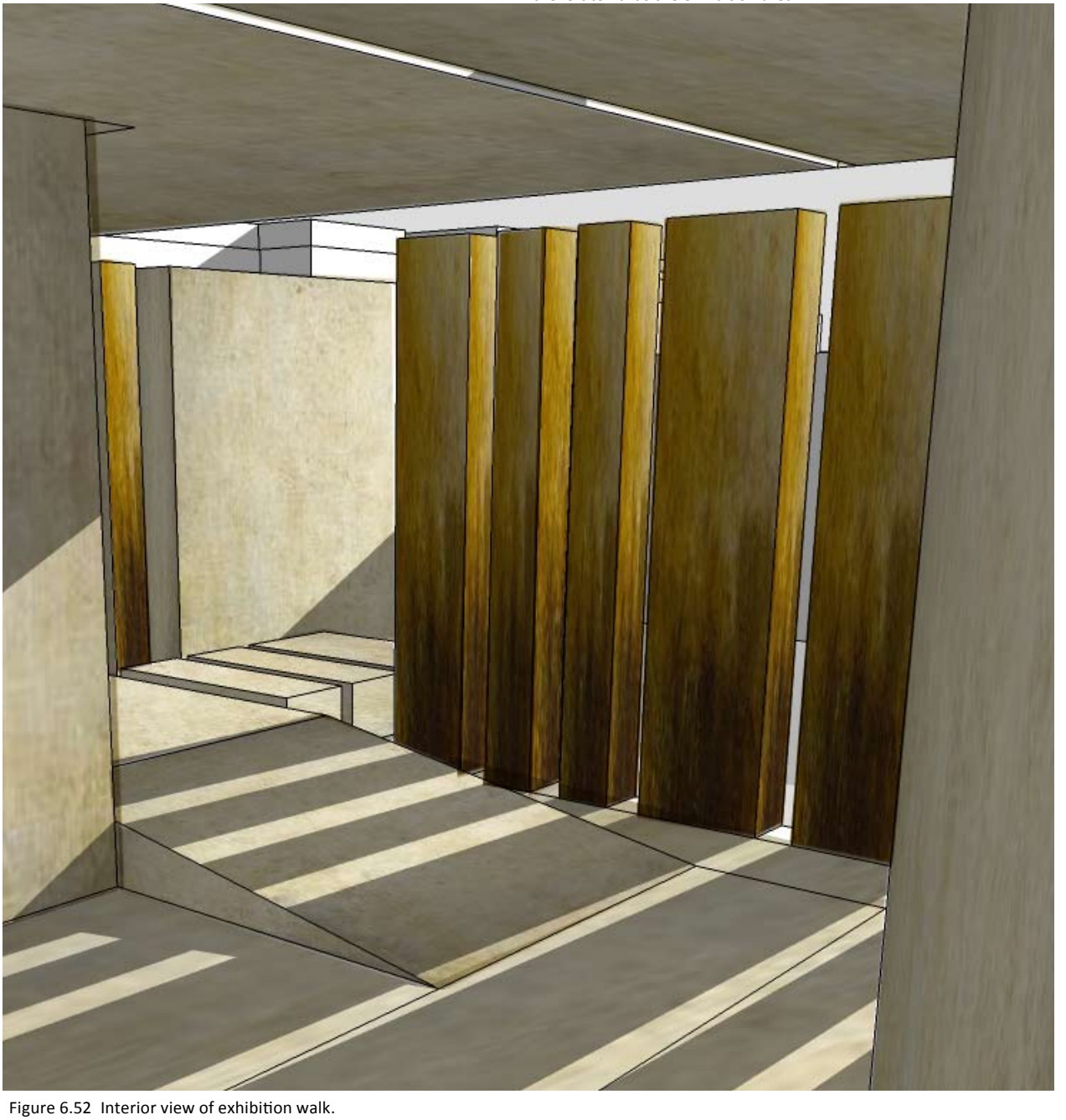


Figure 6.52 Interior view of exhibition walk.

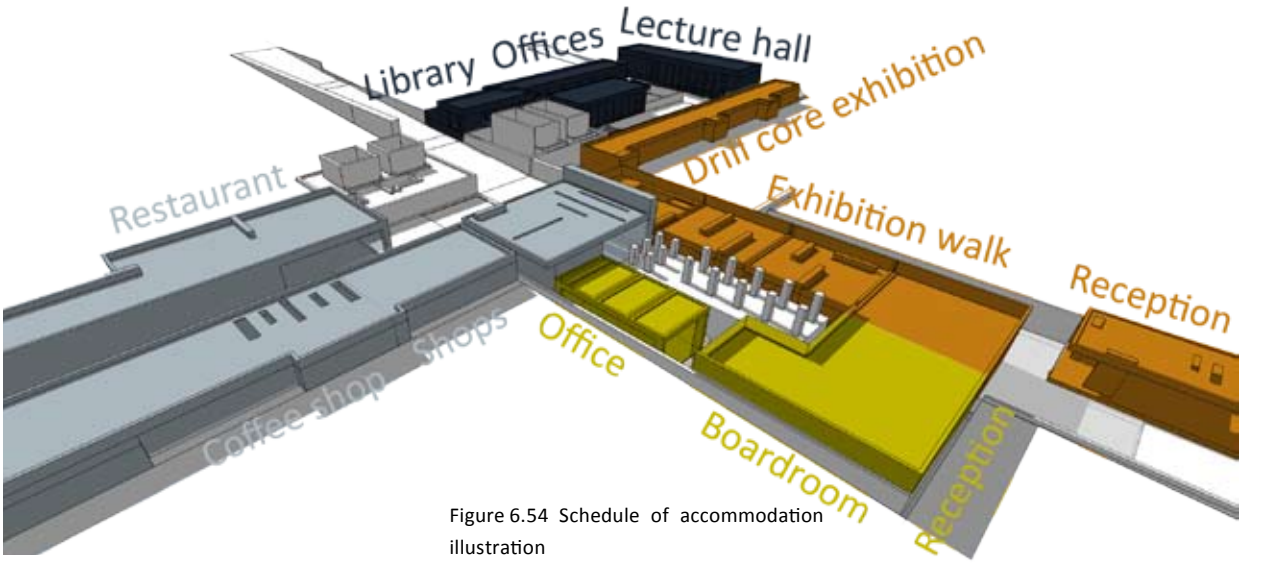


Figure 6.54 Schedule of accommodation illustration

Once the observer emerges from the first phase, the path widens and the visitor is presented with a decision. The workshop where research regarding the site and archaeological diggings takes place is located on the left, while the drill core exhibition is located on the right.

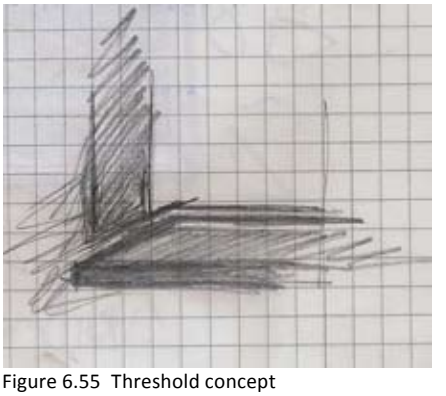


Figure 6.55 Threshold concept

The rhythmic articulation of the different routes is achieved by employing different paving patterns and sized elements representing the surface along which movement takes place. Thresholds and moments for pause are facilitated by means of emphasised surface elements. The scale and proportion of the different elements represent the various tempos at which the visitor travels.

The 'joining' of spaces, routes and larger elements is emphasised by means of threshold elements, attracting attention through material use, detailing or size. These thresholds become a 'celebration of necessity' as Kahn would call them [Murphy, 1999:16].

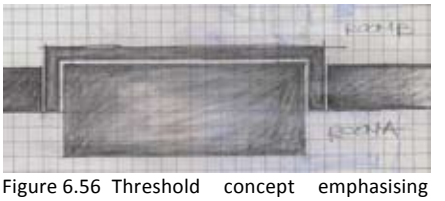


Figure 6.56 Threshold concept emphasising movement from one room to the next

Figure 6.57 Independent floor surfaces with shadow lines, creating a floating effect

The floor surfaces are often independent from the wall structures to suggest floating platforms, drawing attention to them as individual elements emphasising the movement route through the different spaces and the separating void between the new and the existing.

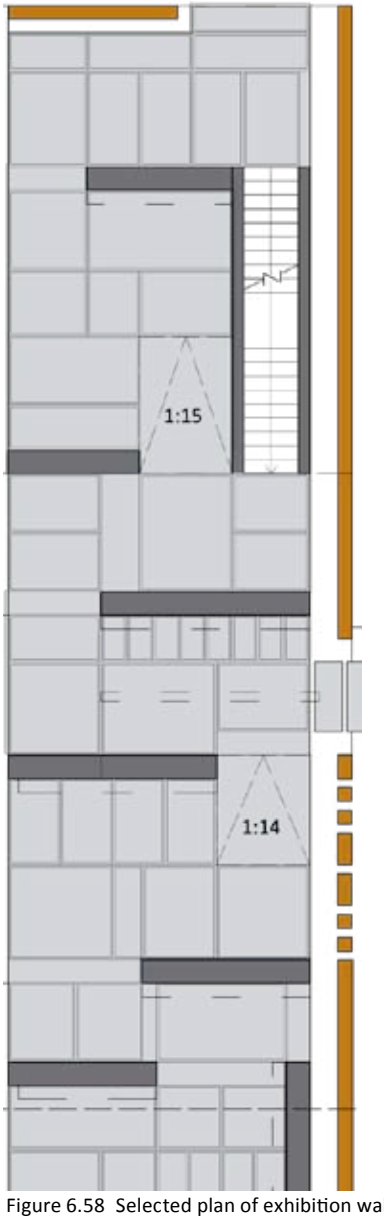


Figure 6.58 Selected plan of exhibition walk illustrating the different floor patterns.

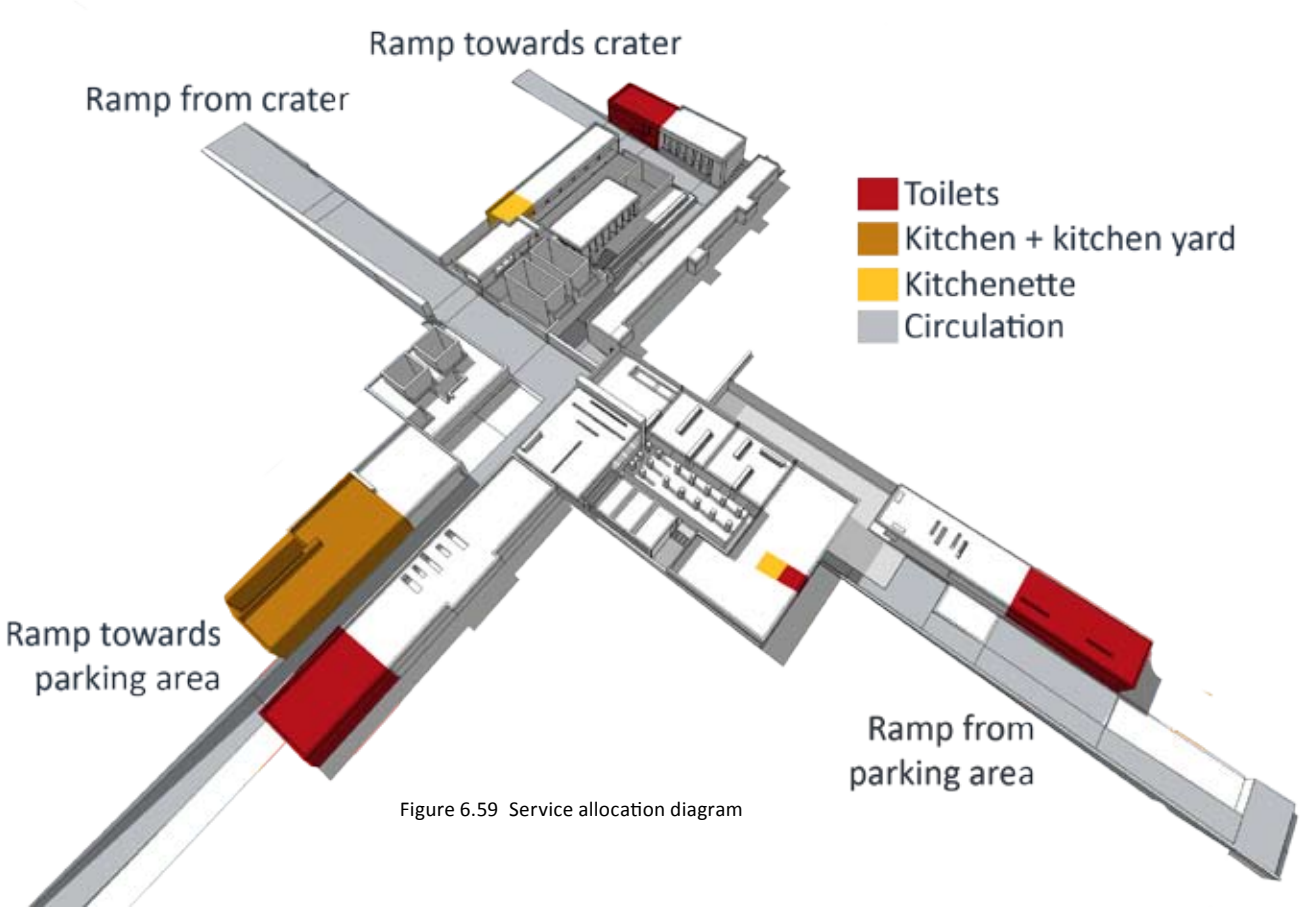


Figure 6.59 Service allocation diagram

6.9 Memory in architecture

The re-articulation of the perceived factory ruins, existing spaces, structures and volumes transforms an expired memory into an indirect memory that can be experienced by the observer as the existing structures are combined with a contemporary inspiration.

The flow of running water plays upon the original flow and flush of water which formed part of the salt and soda extraction process. The different accelerations and auditory qualities of the water evokes the memory of the factory process, while the echoes of the visitors' voices and footsteps become reminiscent of a once vibrant and alive process-driven architecture re-activated by the activity of movement and interaction in and through the spaces.

Selected elements of the original structure are left to decay over time. In this way the natural process is enabled to continue with spontaneity.

An attempt is made to clear out the existing structures, remove excess rubble and expose the different layers of construction, materials, and textures in the process. The existing shell structure becomes part of the exhibition, narrating the history of the site. The idea is to make the history visible, rather than pretending to re-enact it by overlaying fragments of construction.

Due to the mysteries revolving around the exact functioning of the factory, literal translations have been avoided. Abstract interpretations focus on the sensory experience of the visitor by means of experimenting with the sounds, temperatures and visual stimulation of materials, light, shadow and water.

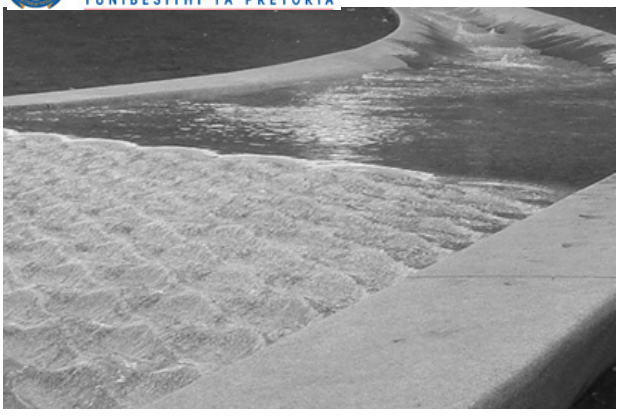


Figure 6.60 Movement of water over different textured surfaces influence the visual and auditory effect. Diana memorial, London [June 2009]

Figure 6.61 Falling water at the Barbican in London [June 2009]

Figure 6.62 Cascading water. Chatsworth, England [June 2009]

6.10 Working within existing structures

In The lamp of Memory John Ruskin states:

[It] is impossible, as impossible as to raise the dead, to restore anything that has ever been great or beautiful in architecture. That which I have above insisted upon as the life of the whole, that spirit which is given only by the hand and eye of the workman, never can be re-called. Another spirit may be given by another time, and it is then a new building... **[Ruskin, 1849:269].**

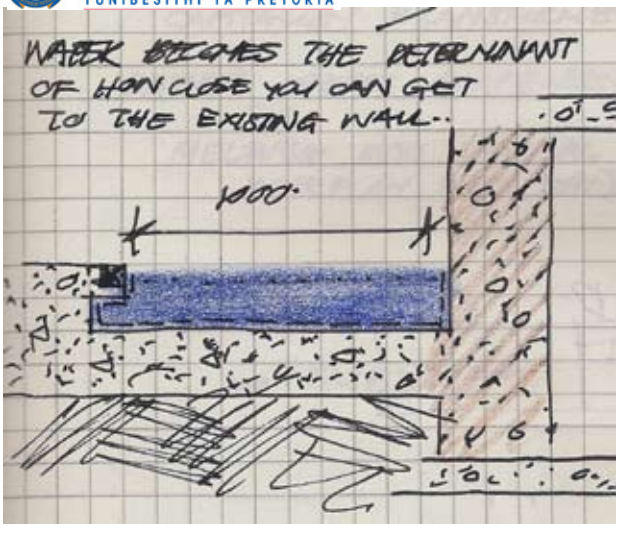


Figure 6.63 Conceptual solution to working within the existing structure [August 2009]

The existing structures on the site are by no means representative of great architecture. They do however contain layers of memory that cannot be replaced, representing a certain time and a great influence without which the TMC cannot be fully comprehended.

William Morris exclaims that *It cannot be, it has gone! They believe that we can do the same sort of work in the same spirit as our forefathers whereas for good and for evil we are completely changed and we cannot do the work they did. All continuity of history means is after all perpetual change, and it is not hard to see that we have changed with a vengeance, and thereby established our claim to be the continuers of history'* [Murphy, 1990:4].

The dilapidated structures present an opportunity for daydreaming as the unrepresentable, uncoded, sensual, heterogeneous character of the ruin creates endless possibilities in the mind's eye.

Ruins convey a sense of melancholy. They may be considered as emblematic of the cycle of life and death, i.e. symbolic of the inevitable. The natural world becomes the home to which the human life and its structural realm will inevitably return, despite any pretentious attempts at achieving immortality. Ruins echo memories of what once was. These memories cannot be recreated, but should not be obliterated either.

The existing structures are generally unstable due to the fact that they have been almost completely ignored since the demolition of the factory in the 1970's.

According to Anne-Catrin Schultz, '[m]ere reconstruction avoids the complexity of time by replicating a destroyed object and thus pretending a continuous existence' [Birksted, 2000:50].

The architect's role, in this case, is to be an instrument for the continuance of history. To preserve as much of the memory as possible, a decision was made to retain the structures as far as possible, and to design around them, enabling visitors to experience the structures in a stable environment.

In the design approach, there seemingly is an overlay of solid and void, the structure being neither totally excavated, nor completely demolished. Imagination allows one to simultaneously see both elements, in a composition that is complete yet contradictory. The expressed gap between old and new suggests a moment of transition as the new structure claims its place while the old ruin remains.

The concept of layering is applied where the nature of the new layer over the old one is precise, positive and controlled in contrast to the decomposing existing structures weathering over time. The demolishing, excavating and cleaning of the existing structures can be considered subtractive while the new intervention of constructions within the existing represents an additive process.

The existing structure and new interventions are juxtaposed. New elements are inserted into the existing context, leaving a void between the two to allow each to exist on its own, yet to simultaneously connect the previous era with the present and visually draw attention to the intrinsic differences between them.

The separated elements can be regarded as a confirmation of the new as merely another discontinuous layer inserted within the existing. The intervention becomes a continuation of history. Rather than merely restoring or preserving, room is provided for the narrative to continue.

Incisions are made in the existing structure to reveal the construction and materiality of the existing as it dematerialises over time.

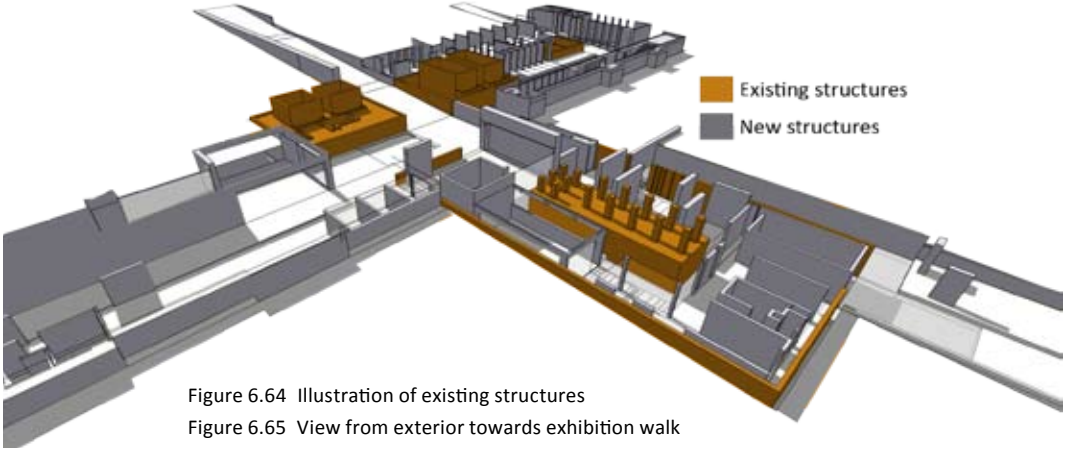


Figure 6.64 Illustration of existing structures
Figure 6.65 View from exterior towards exhibition walk

6.11 Museum design

One problem that has been identified is that there is currently no information available regarding the TMC and its related history at the Natural Cultural Historic museum, or at the Transvaal Museum. Due to a veld fire that started outside the fence of the TMC on 23 August 2009, the existing visitor centre and 500ha of the reserve were burnt down.

Museums facilitate education in a relaxed atmosphere, where people can be educated in an informal manner. When museums evoke curiosity, interest is awakened and the information presented is automatically remembered more efficiently.

Museum design can be regarded from two perspectives. On the one hand, neutral rooms resembling warehouses can be created and filled with almost anything, providing a clean canvas for an exhibition. On the other hand, the exhibited artefact can determine the design of the space as in Carlo Scarpa's Castelvecchio intervention. Here the approach seems to be almost theatrical as the works communicate directly with the visitor in the specifically designed volumes.

The proposed "memoseum" was deliberately not designed to be a conventional exhibition space with large exhibition rooms and great volumes.

'Trop d'espace nous etouffe beaucoup plus que sil n'y en avait pas assez' ('Too much space smothers us much more than if there were not enough'). [Bachelard, 1965]

This type of museum encourages exploration. The proposed project can be regarded as a defined part of the route through the site. The visitor is guided through a sequence of evocative spaces comprised of a combination of new and existing structures filled with slivers light that highlight fragments of information regarding the site and its history. The visitor is educated while progressing towards the main attraction of the site, the crater.

Figure 6.67 View of interior of exhibition walkway with slivers of light entering the space and the existing structures on the left

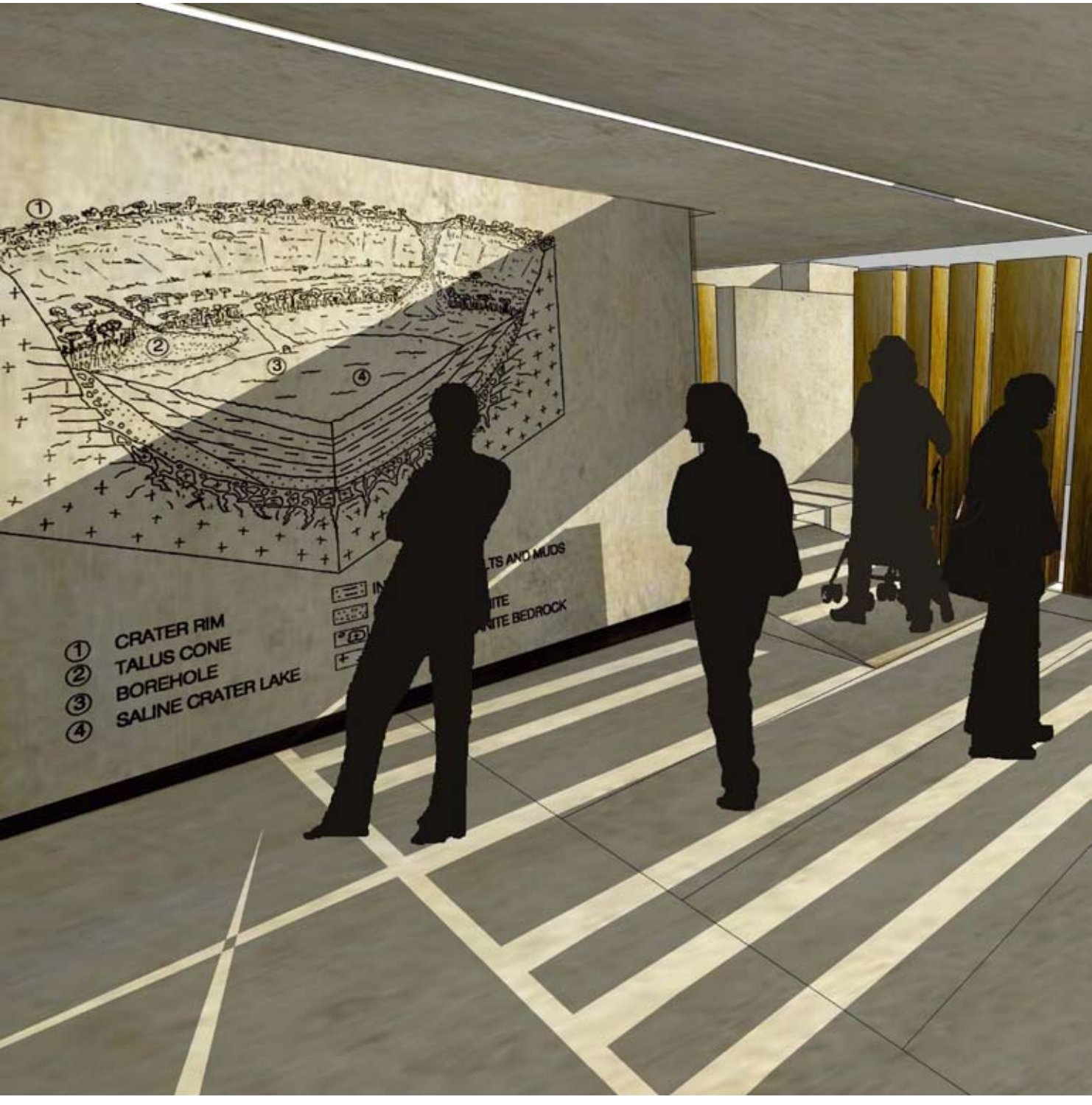


Figure 6.68 View of interior of exhibition walkway with slivers of light entering the space through the existing structures on the right

Figure 6.69 View of interior of exhibition walkway with slivers of light entering the space through the existing structures on the right

Figure 6.70 Exterior view of exhibition walkway with the exterior pond and water spouts

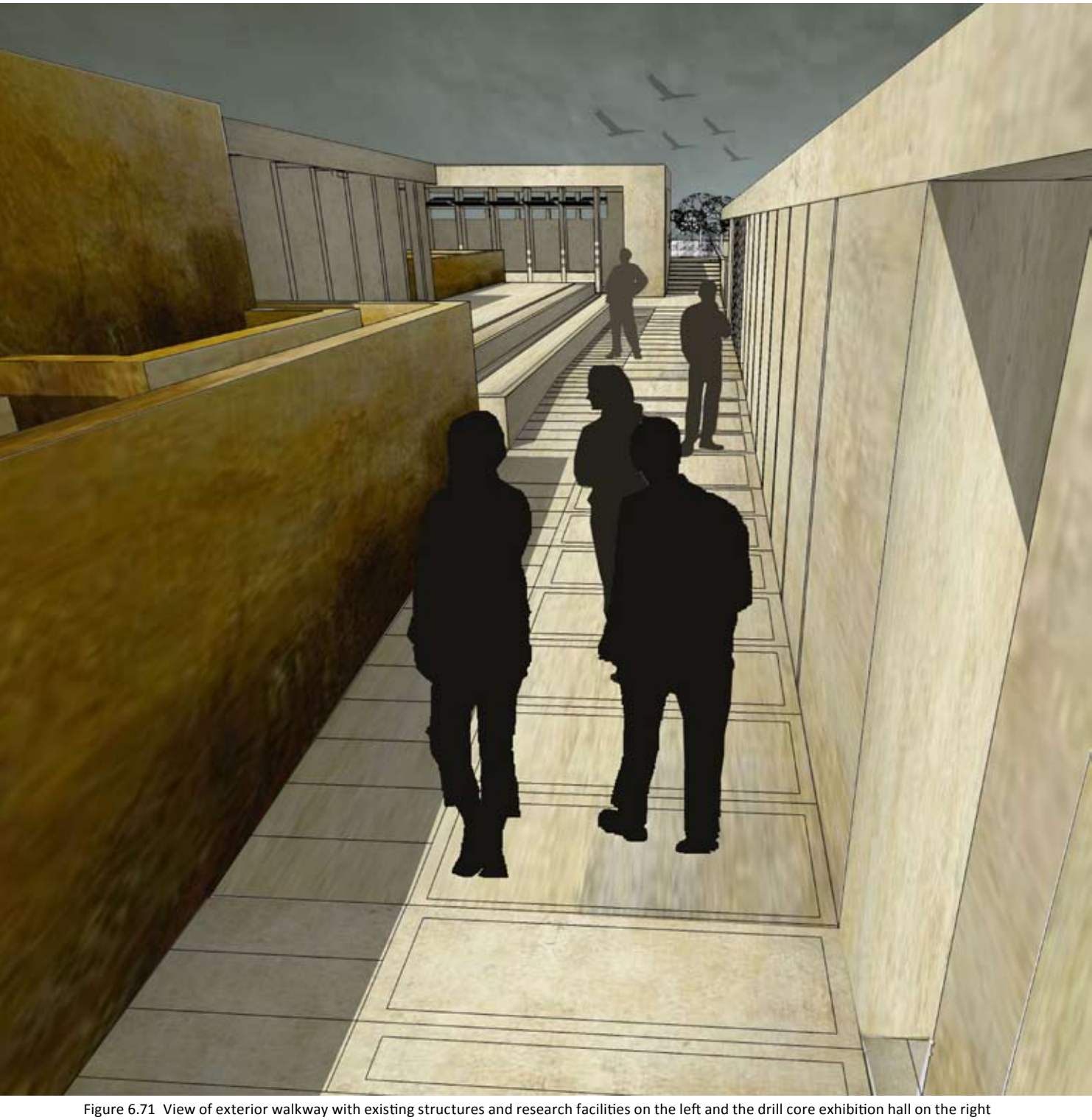


Figure 6.71 View of exterior walkway with existing structures and research facilities on the left and the drill core exhibition hall on the right

Figure 6.72 Interior view of drill core exhibition walkway with slivers of light entering the space

Figure 6.73 View of research library and ramp towards the shop from the crater

Figure 6.74 View of shop integrated with the existing structures, and existing structures in the background

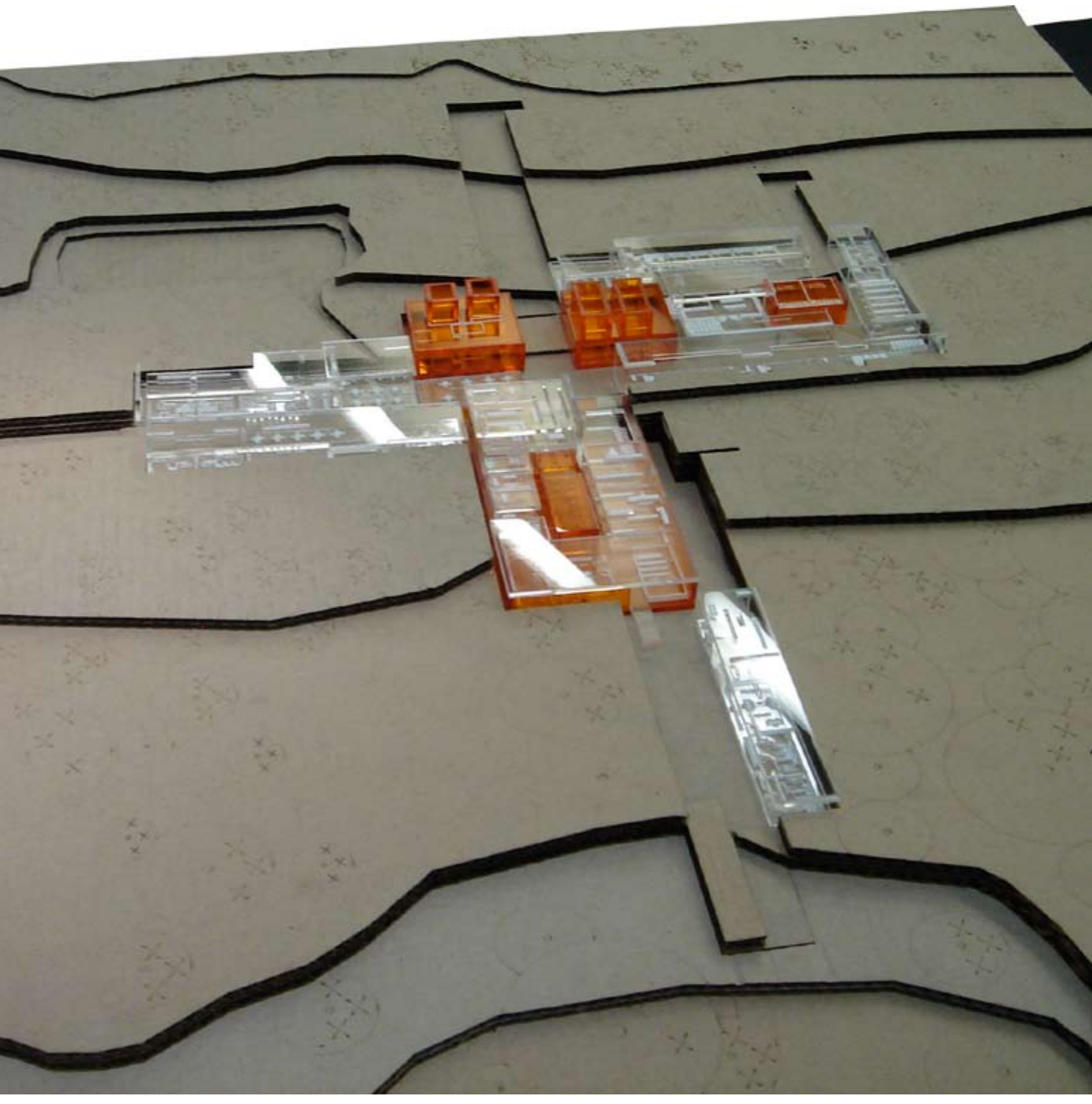


Figure 6.75 Physical model, constructed of layered cardboard contours with etched trees, and perspex model with engraved plans

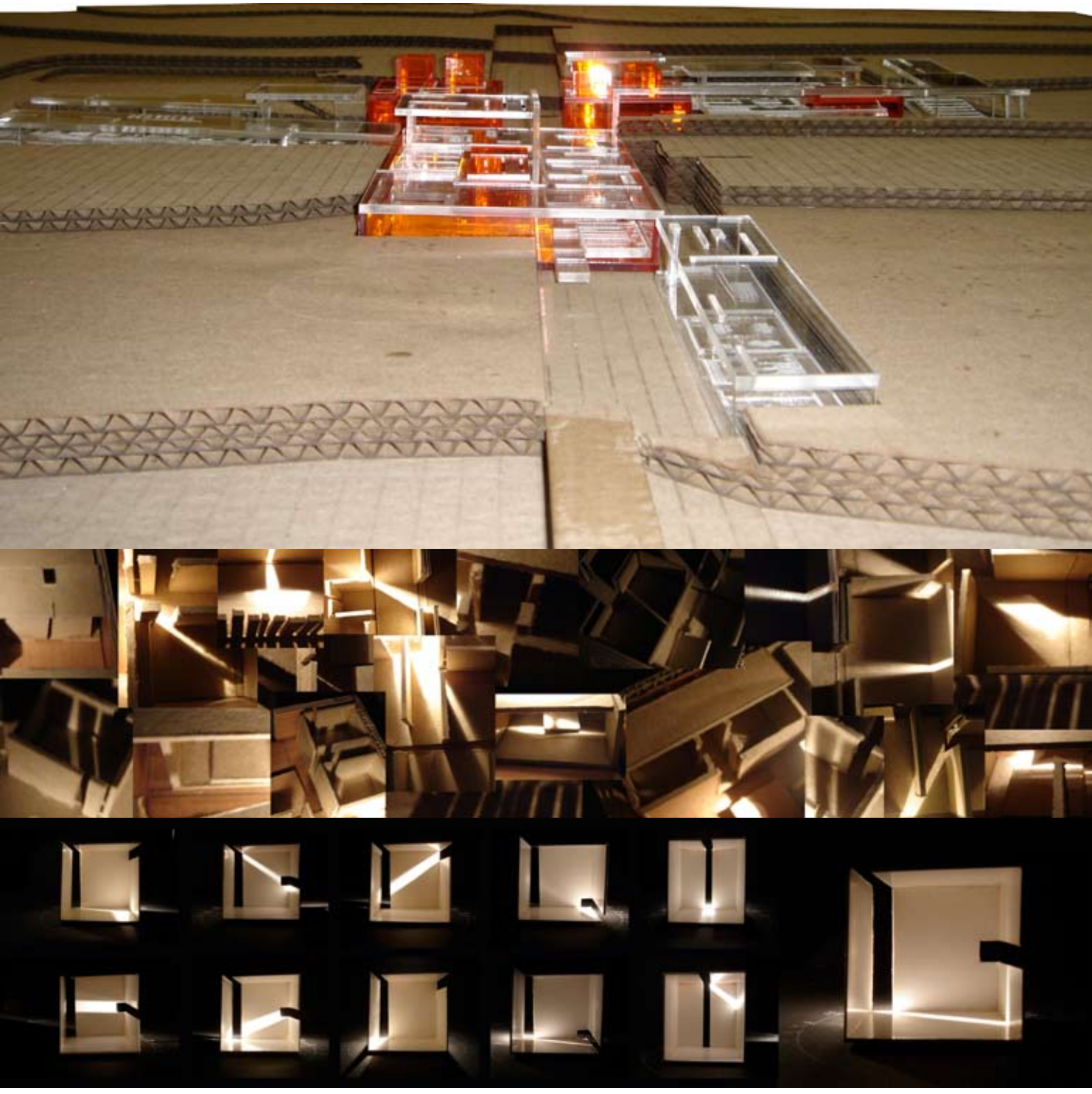


Figure 6.76 Presentation graphics of physical model and abstract light experiments

07 TECHNICAL INVESTIGATION

The technical investigation highlights certain elements regarding the construction of the design proposal. It is important to emphasise that the construction was simplified for various reasons such as financial feasibility and ease of construction.

The sustainability of the project was an important element and guideline throughout the design process.

The technical documentation follows the technical investigation as a separate set of drawings to be referred to.

The technical investigation discusses the various decisions that were made with regards to the technical aspects of the design. Resolutions were mainly determined by the existing structures and construction methods and by the experiential quality of the design, including elements such as material use, thermal comfort and aesthetic contrasts.

The technical resolution of the design was simplified as much as possible for various reasons.
The uncomplicated construction methods enable the local community to be employed for the construction phase of the design. The cost effectiveness of the design and construction was a stressed concern, as the limited financial resources available at the moment is one of the greatest problems at the TMC. The sustainability of the project was another important element. The concrete structures offer both aesthetic appeal and cost effectiveness. Its strength, durability and natural thermal mass result in a building that require low maintenance, offer high durability and have high operating energy efficiency.

Due to the haphazard construction of the salt and soda factory, no obvious grid system exists. The existing structures were used to guide the spatial layout of the design.

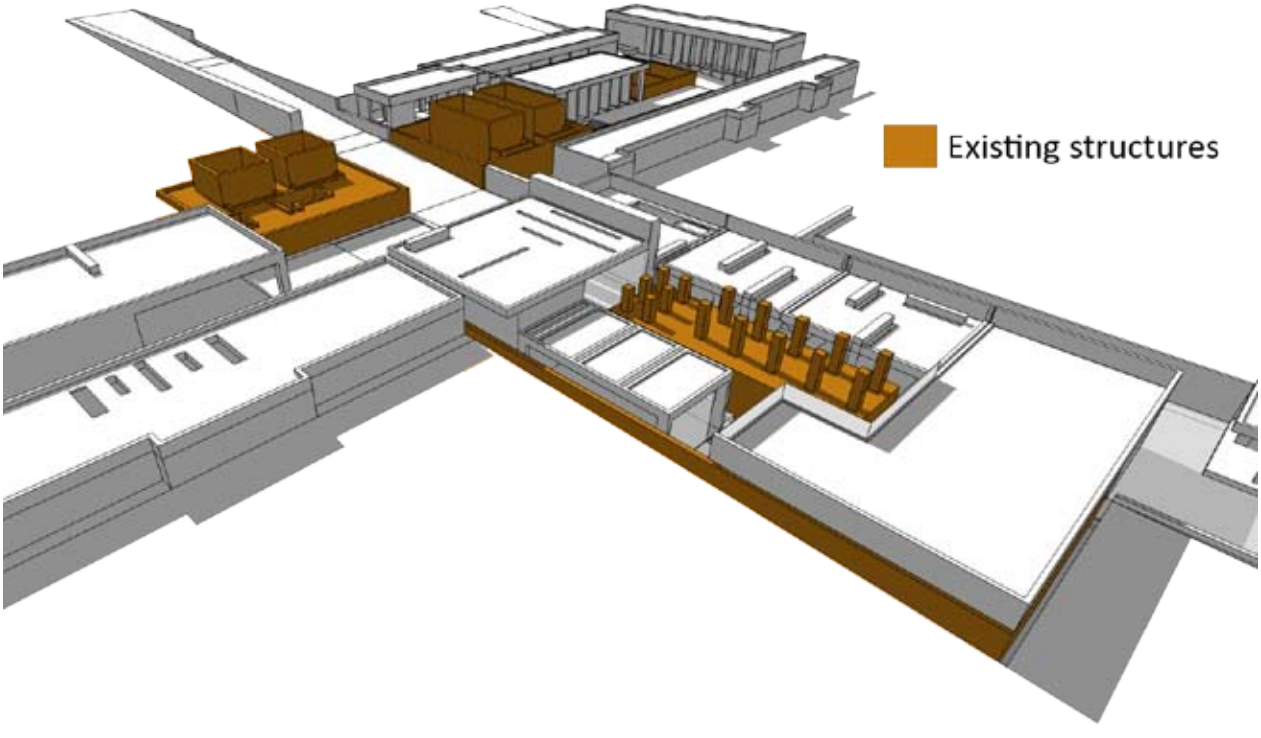


Figure 7.01 Illustration of existing structures in relation with the proposed intervention

7.1 Structure and materiality

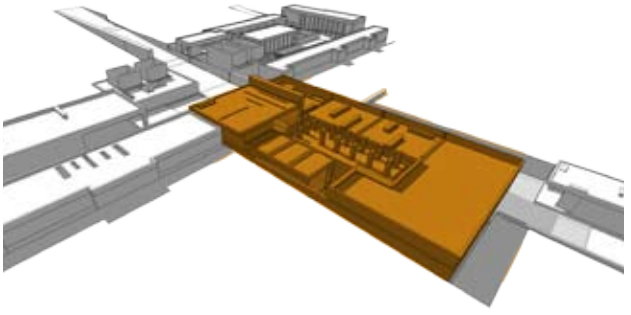
The existing reinforced concrete structures are decaying over time. The reinforcing elements are corroding due to the high salt content of the water that was used during the construction of the factory.

This fact rendered the option of incorporating reinforced rammed earth elements unfeasible as the soil around the factory would inherently have a high level of salt content as well, recreating the existing problem of corroding reinforcing elements.

The decision was made to retain the existing structures as far as possible and develop the design around these elements. In this way, the existing memory of the factory would be maintained and continued as the structures are left to decompose over time.

The primary structural system employed in the new design consists of reinforced concrete walls and reinforced concrete roofs. The decision was made to insert a new layer of construction within the existing structure by using the same construction material [reinforced concrete], due to its aesthetic association with the existing structures, cost-effectiveness and availability. The design also took advantage of the thermal mass and structural integrity of concrete as construction material.

Figure 7.02 Existing corroding reinforced concrete structures. It is suspected that these structures were used as storage tanks for the water and brine that was pumped from the crater floor. [August 2009]



In general, and where possible, a void ranging between 600mm and 1m was left between the new and existing structures, allowing the existing structures to gradually decompose over time, and simultaneously acting as a service shaft between the new and existing elements.

Water was integrated in the design as an element between the new and existing structure.

Figure 7.03 The key plan with the selected area illustrated in the plan below.

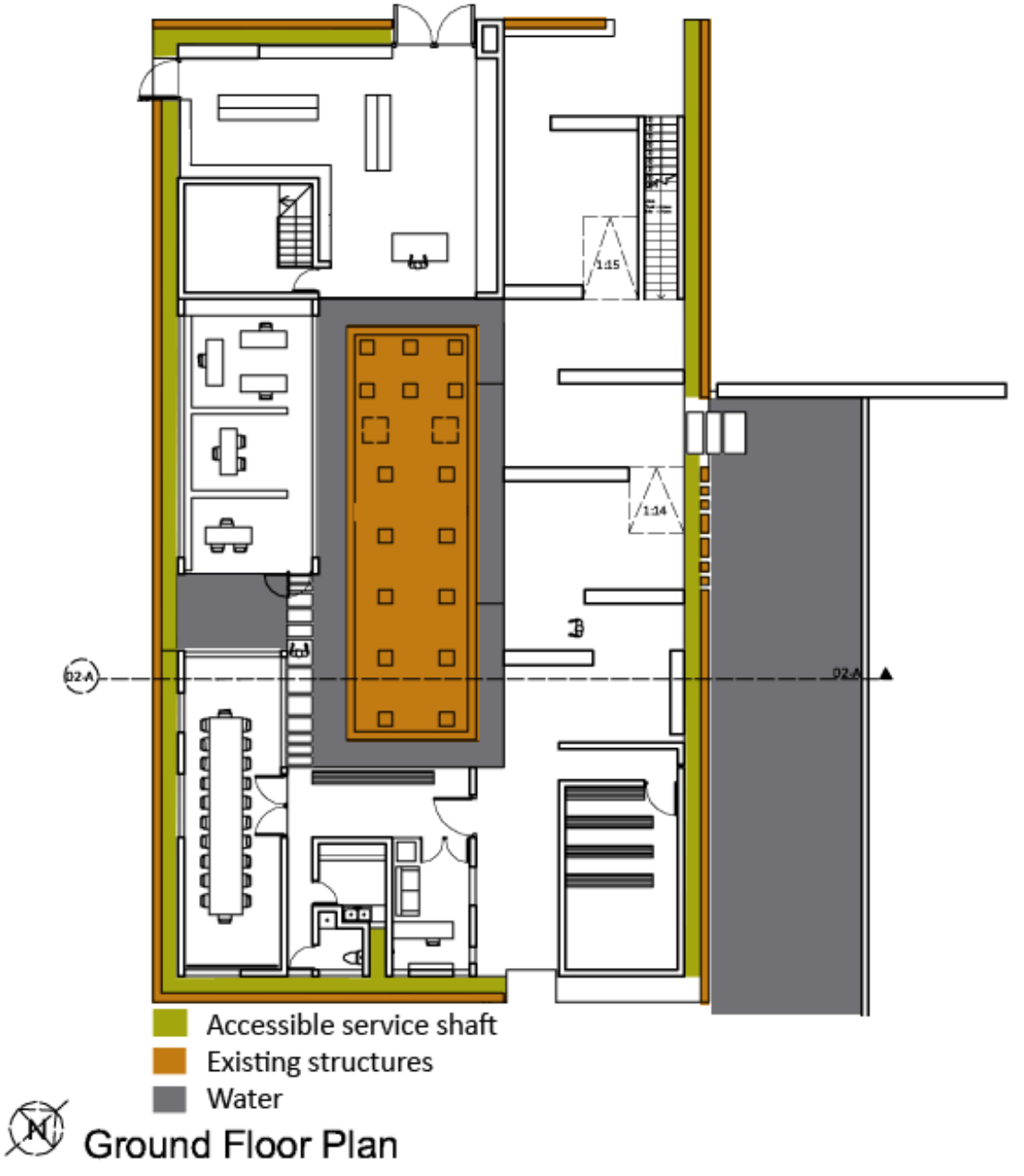


Figure 7.04 Selected plan, indicating the intervention of new structures within the existing structure.

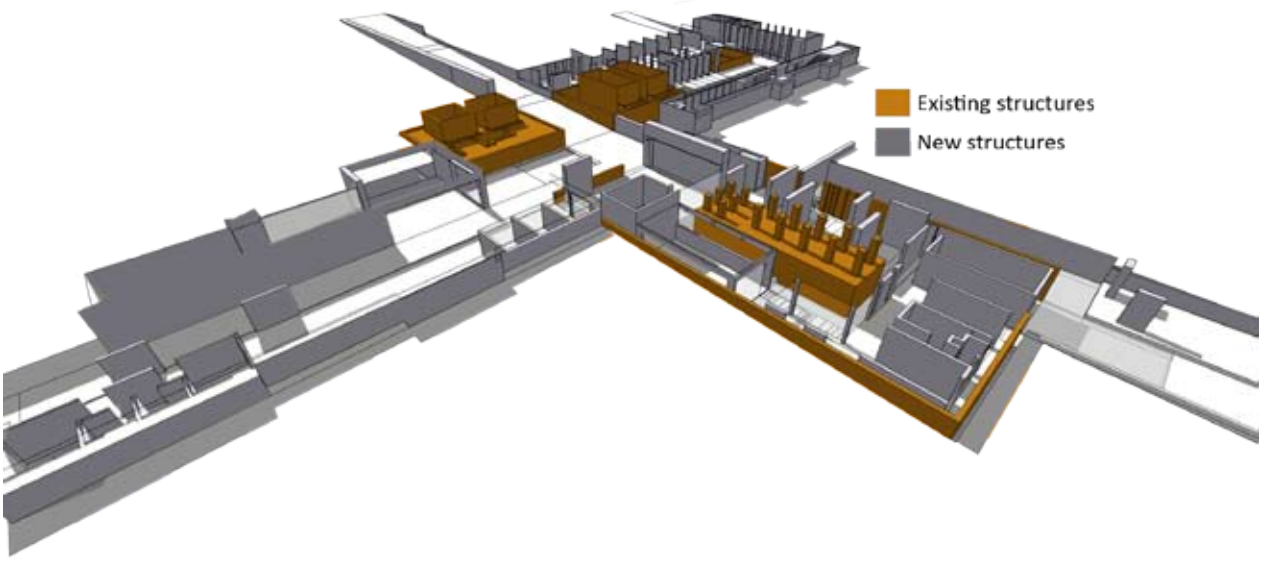


Figure 7.05 The new concrete structures in relation to the existing structures.

The existing structures range from storage tanks with a depth of approximately 3m underground, to open storage tanks rising approximately 2.1m above the natural ground level. The scale, proportion and rhythm of these structures greatly influenced the design. The majority of the new structures have floor levels that generally range from 3m below the natural ground line, to walkways that lead the visitor from these low levels up to the natural ground level.

The new structures consequently consist of reinforced concrete retaining walls defining the volumes below ground.

CALCULATIONS

Reinforced solid concrete slab

L = Typical span [2000 - 7000]

d = Typical depth [100 - 250]

L/d = Typical [22 - 32]

7000/255 = 27,45

Applied depth of 255mm over a typical span of 7000mm. [Orton, 1994:34]

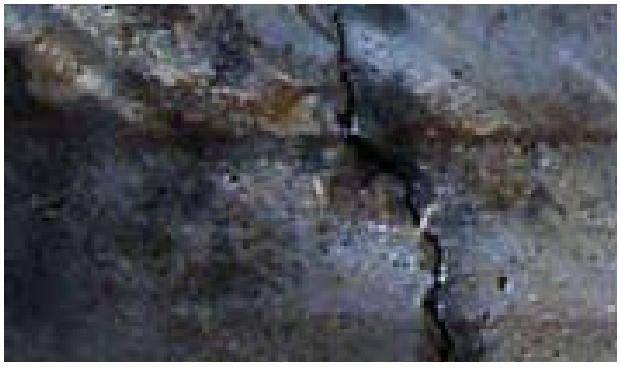


Figure 7.06 Materiality of existing concrete structures

Figure 7.07 Materiality of existing concrete structures

Figure 7.08 Texture of existing concrete structures

7.2 Roof

The green roof structure acts as another plane, planted with local veld grass to ensure minimal visual impact on the surrounding landscape, allowing the structure to blend in with the natural vegetation. The roof over the first exhibition space is accessible and planted with tufted grass. The remainder of the roofs are also planted with the local veld grass, but are inaccessible to the general public. In addition, the roof element acts as a thermal insulator, enhancing the thermal comfort of the user.

Peter Zumthor's Thermal Baths at Vals was used as inspirational precedent. In his design, all the concrete roof structures are separated by an 80mm gap which is covered with a glass panel, allowing natural light to penetrate the space while simultaneously preventing rain from entering the structure.

This concept was reinterpreted, and adapted to the construction of the design.

Figure 7.10 Thermal Baths, Vals - View of roof detail [Arte France, 2003]

Figure 7.11 Thermal Baths, Vals - View of roof detail [Arte France, 2003]

Figure 7.12 Thermal Baths, Vals - Interior view of roof detail [Arte France, 2003]

Figure 7.09 Local veld grass [August 2009]

Figure 7.13 Green roof detail of Peter Zumthor's Thermal Baths [Arte France, 2003]

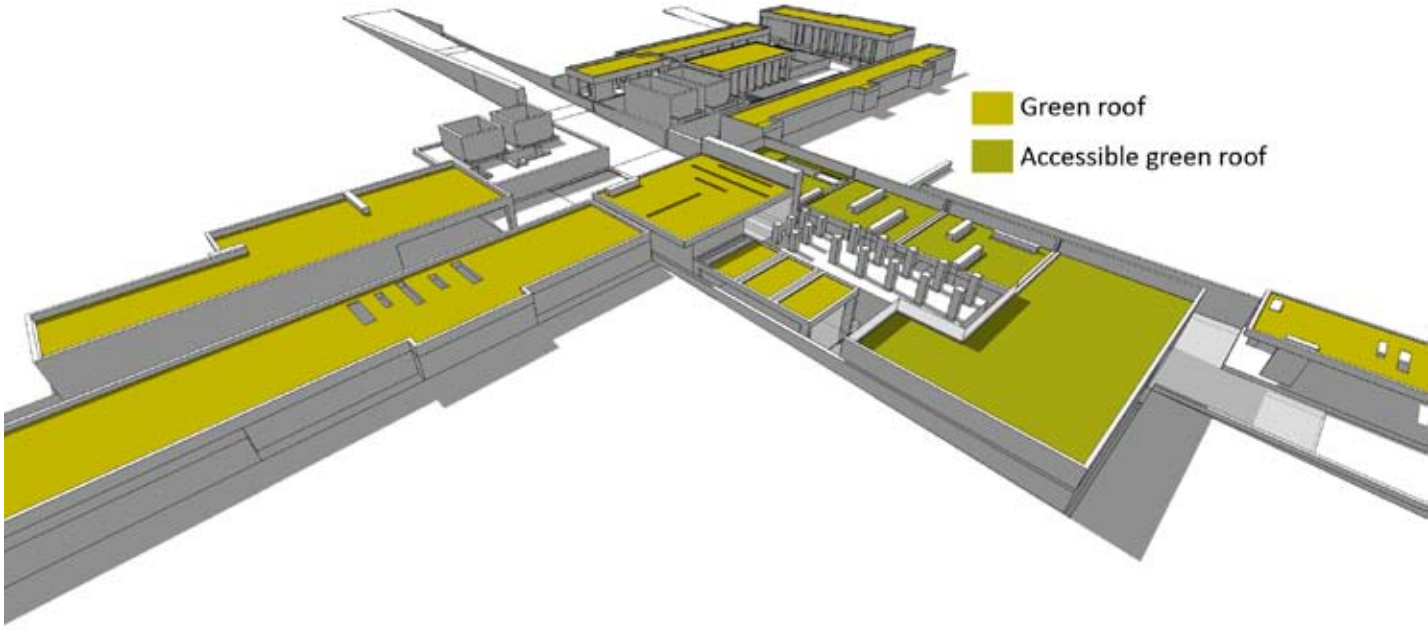


Figure 7.14 View of the design proposal indicating green roof areas.

7.3 Storm water

Green roofs have multiple advantages including the reduction of storm water runoff as opposed to conventional roof types. Furthermore, due to the semi-submerged nature of the structure, the design of storm water runoff is essential to prevent the building from becoming a retention pond. The storm water system is designed to collect, discharge and dispose the runoff water. The water is controlled by storm water channels, vegetation, catch pits, pipes and retaining walls. The approach to the storm water management consists of temporary storage and gradual release into a conveyance system.

The runoff system is partially on and below the surface, whichever is the appropriate solution in the various areas. The runoff water is discharged into the natural landscape, reducing the excessive erosion at the exit point by means of a head wall structure.

7.4 Water elements

Water is employed as a design element, reminiscent of the water flowing processes used during the operating of the factory. Water as element play a role in the aesthetics, sensory exploration and thermal environment created within the structures. The chlorinated water system is operated by a pump, circulating the water to ensure constant movement, avoiding stagnant situations that could attract insects and result in other related problems such as excessive algae. The first pump is located under the raised floor of the shop, circulating the water in the internal courtyard, while the second pump is submerged behind the retaining wall at the entrance, serving the pond next to the reception area. Both water features have overflows to ensure that the water is drained away, should an excessive amount of water be present.

7.5 Sustainability

As architect, and designer of the concrete environment, conserving the environment is of undeniable importance and an urgent obligation towards the local community as well as the valuable planet.

The *Sustainable Building Assessment Tool* [SBAT] system, developed by Jeremy Gibberd from the CSIR was used to determine the sustainability of the design. The system is divided into three different sections, consisting of social, economic and environmental sustainability.

Both the effect on the local and global environment as well as the comfort and health of the building occupants should be taken into account during the design process.

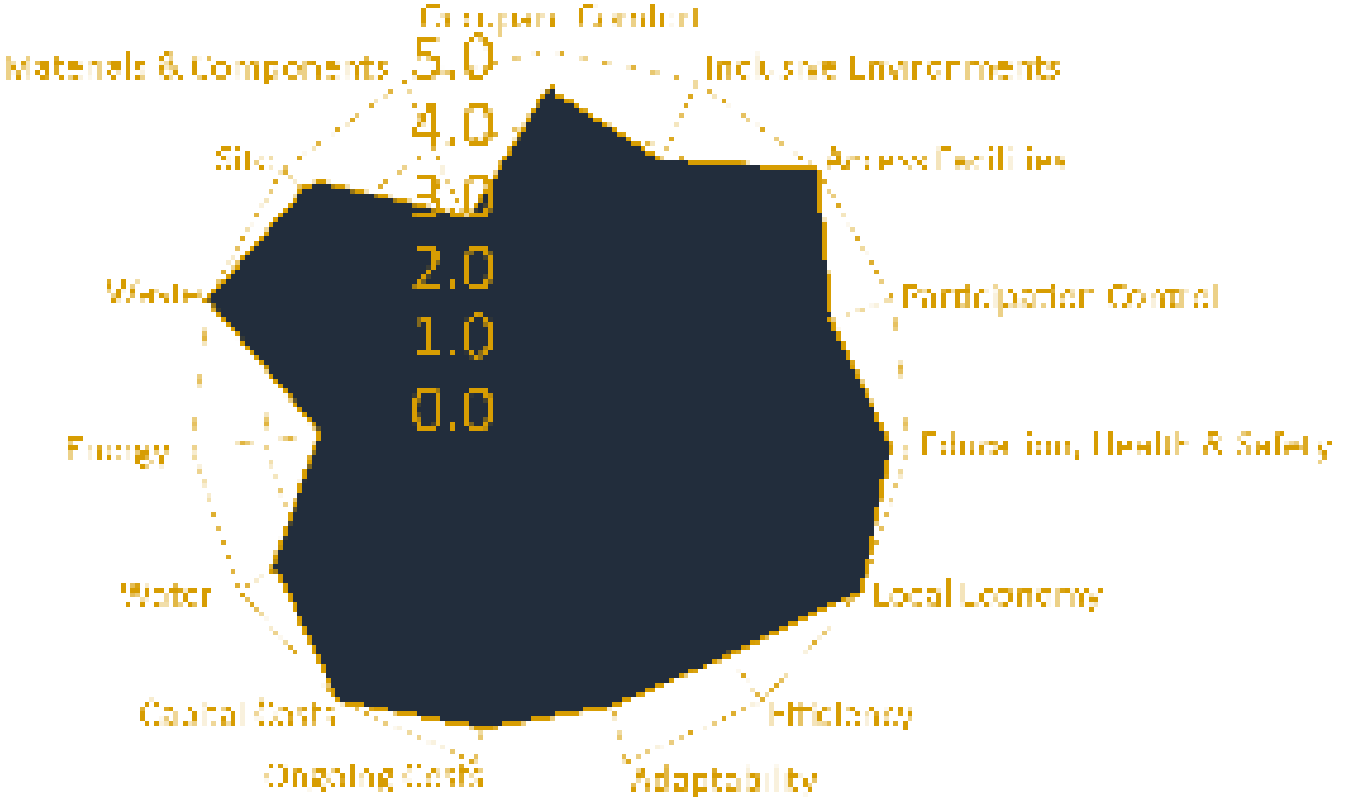


Figure 7.15 Sustainability graph indicating the different levels of sustainability of the design proposal according to the SBAT assessment tool [October 2009]

Social sustainability

The social sustainability segment of the tool presents an indication of the social performance of the building.

The strength of the social sustainability of the project lies within the occupant comfort. The general open nature of the structures enable natural light and ventilation throughout the design. Users have the ability to control their own internal environment by means of openable windows. Visual contact with the exterior environment is encouraged by means of roof lights and window openings.

Inclusive design was one of the main design concerns, ensuing structures that were purposefully designed with connecting ramps between the various levels to provide access for wheelchair users and other physically impaired users.

Due to the location of the project in the Nature Reserve, public transport is limited. It is however assumed that the proposed MCDC will be implemented in the future, improving accessibility. The SBAT tool is generally compiled for office buildings and residential units, which illustrates the proposal as weak in terms of access to public amenities. This portion of the assessment was therefore ignored as the relevance is limited due to the nature of the building typology as an interpretation centre.

The regular user would comprise of the administration personnel, management, cleaning and cooking staff who would generally come from the surrounding settlements of the Soutpan community and Soshanguve.

Workforce from the local community will be employed and trained during the construction of the centre.

As a result of the careful consideration of the above mentioned items, the assessment provided an outcome of 4.4 points out of 5 which places the social sustainability within the 'excellent' range.

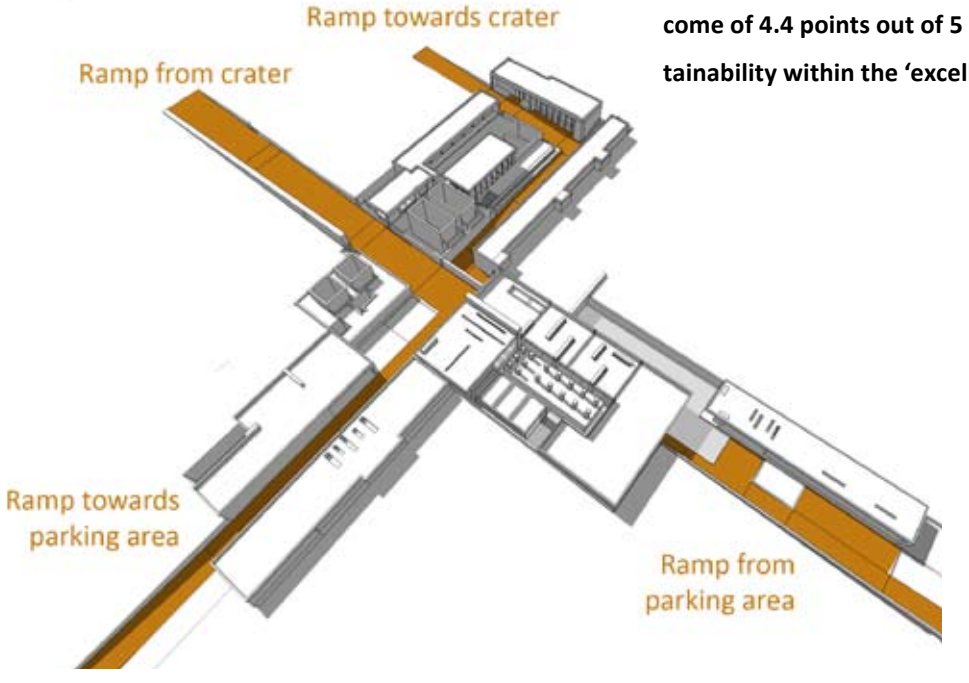


Figure 7.16 Illustration of ramps throughout the design

Economic sustainability

The economic sustainability section of the assessment provides an indication of the economic performance of the building.

The proposed project will make use of local available materials and workforce as well as well-known, uncomplicated construction techniques that enable basic training and education of the local community members during the construction phase.

The environmental sustainability assessment, provides an indication of the environmental performance of the building.

Grey water will be recycled on site and re-used where possible. Green roofs are included in the design to minimise the visual impact of the structures in the natural landscape. Local veld grass is used on the roofs, reducing the maintenance and water needed.

Environmental sustainability

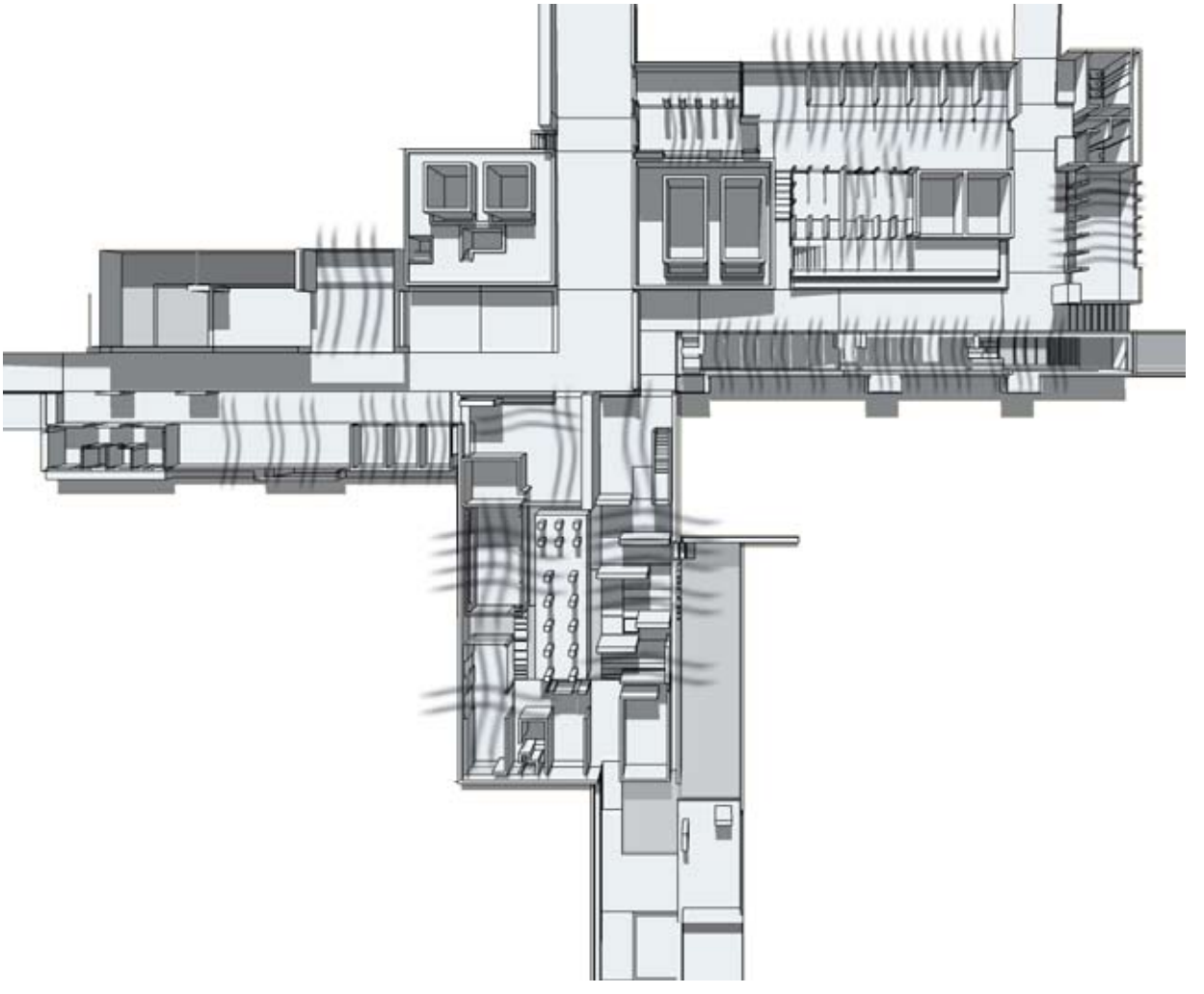


 Figure 7.17 Plan indicating natural cross ventilation throughout the structures.

Energy efficiency is increased with the use of concrete as construction material. Concrete is produced locally and offer considerable energy savings over the lifetime of the structure by means of energy efficiency and low maintenance costs. The thermal mass of the concrete structure in conjunction with the isolating properties of the soil within which the structure is submerged reduces temperature swings, the structure becomes a thermal reservoir with the ability to store large amounts of energy. A year-round energy-efficient building is produced due to the relatively stable temperature that is maintained within concrete structures, as the concrete walls and floors absorb heat during the day, and consequently radiate the warmth back into the space at night. [http://www.cnci.org.za/concrete_benefits.htm accessed 2009.10.12]

The distinct advantage of windows and openings have been exploited as far as possible. Natural light guide visitors through the structures with the exception of artificial lighting where climatic conditions may render natural light as insufficient. The pale surfaces increases the amount of available natural daylight. The external courtyards allow increased levels of natural light and ventilation to enter the semi-enclosed structures.

Adjustable elements such as blinds, openable windows, roof overhangs and ventilation respond to changing climate conditions. Natural cross ventilation is employed throughout the design and provides fresh air from outside as well as a cooling effect as the air moves through the space, replacing the hot interior air with cooler air from outside. The openable windows that extend up to the roof slab allow hot air in the upper part of the rooms to escape.

Figure 7.18 Diagrammatic illustration of a roof light as employed within the exhibition area and administration office.

Figure 7.19 Diagrammatic illustration of a light shelf as employed in the research offices.

Figure 7.20 Diagrammatic illustration of a window opening employed throughout the design.

Figure 7.21 Diagrammatic illustration of reflective blinds employed throughout the design.

The structures are orientated to take advantage of natural daylight with the appropriate window openings yet eliminating solar overheating by allowing more sunlight in during the winter and less during the summer. The pale hard concrete surfaces keep down surface temperatures as solar reflection is radiated.

The noise impact on the occupants are reduced to an absolute minimum as the location of the building in the Nature reserve is protected from excessive vehicular traffic. The nature of the occupancy of the building encourages conversation rather than contemplative silence, rendering the structure alive, reminiscent of the factory activities. The hard concrete surfaces produce a contrasting acoustic quality to the exterior landscape. Building services are reduced to an absolute minimum as passive cooling is employed throughout the design.

The concrete surfaces throughout the design render maintenance and cleaning of the building as trouble free. The majority of the spaces can be hosed clean due to the open nature of the structure.

Water saving devices such as dual flush toilets, infrared sensors fitted to taps and rainwater harvesting are proposed to be included in the building.

The sewage is recycled on site by means of a septic tank connected to a french drain. All damaged building materials and waste is recycled into the immediate surrounding community.

The design intervention is located within the area of the historic salt and soda factory, consequently reducing the impact on the environment as the site is considered as previously disturbed. The building becomes an integral part of the site. Existing vehicular routes as well as pedestrian routes are re-employed to reduce any possible disturbances of the natural landscape.

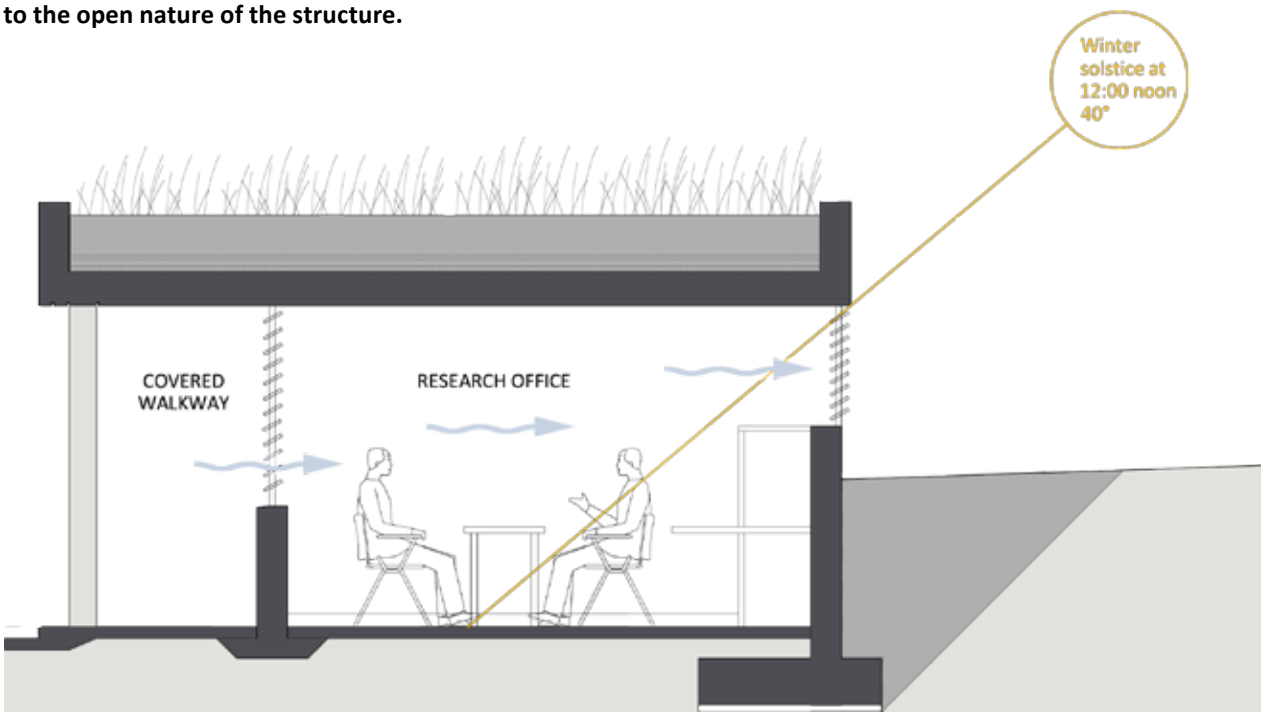


Figure 7.22 Typical section through the research office, illustrating the concept of natural ventilation and natural sunlight as employed throughout the design.

TOTAL CURRENT ESTIMATED BUILDING COST

No	Description	Unit	Area	Rate	Amount excl VAT
1	Reception area including ablutions, office and covered reception area	m²	182	R 5,275.00	R 960,050.00
2	Exhibition walkway, media room, administration offices, shop, store room, etc.	m²	611	R 6,165.00	R 3,766,815.00
3	Public ablutions, coffee shop and three smaller shops	m²	159	R 5,475.00	R 870,525.00
4	Restaurant including kitchen, change rooms, etc.	m²	219	R 6,385.00	R 1,398,315.00
5	Drill core exhibition space	m²	178	R 5,055.00	R 899,790.00
6	Lecture hall	m²	61	R 5,235.00	R 319,335.00
7	Ablutions	m²	38	R 6,485.00	R 246,430.00
8	Workshop and store	m²	69	R 4,835.00	R 333,615.00
9	Research offices and kitchenette area	m²	121	R 5,945.00	R 719,345.00
10	Library	m²	52	R 5,305.00	R 275,860.00
11	Open walkways, ponds, ramps and other areas	m²	2,578	R 1,525.00	R 3,931,450.00
12	External works (path ways, parking area, etc)	Item			R 1,753,500.00
	TOTAL CURRENT ESTIMATED BUILDING COST (EXCLUDING VAT)				**R 15,475,030.00**

VIEWPOINT
[RESERVOIR FOUNDATION]

CRATER RIM

VIEWPOINT
[MANAGER'S HOUSE FOUNDATIONS]

PATH FROM CRATER VIEWPOINT

PATH TOWARDS CRATER VIEWPOINT

1139
1138
1137
1136
1134
1133
1132

INTERPRETATION CENTRE
[SALT AND SODA FACTORY RUINS]

PATH TOWARDS PARKING AREA

PARKING AREA
[FOUNDATIONS OF WARMING PONDS]

PATH FROM PARKING AREA

N

1m 10m

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SITE PLAN

SCALE: REFER TO BAR SCALE
DATE: 2009.11.25
DRAWN: ANJA BREDELL 23337550
DRAWING NO.: 001

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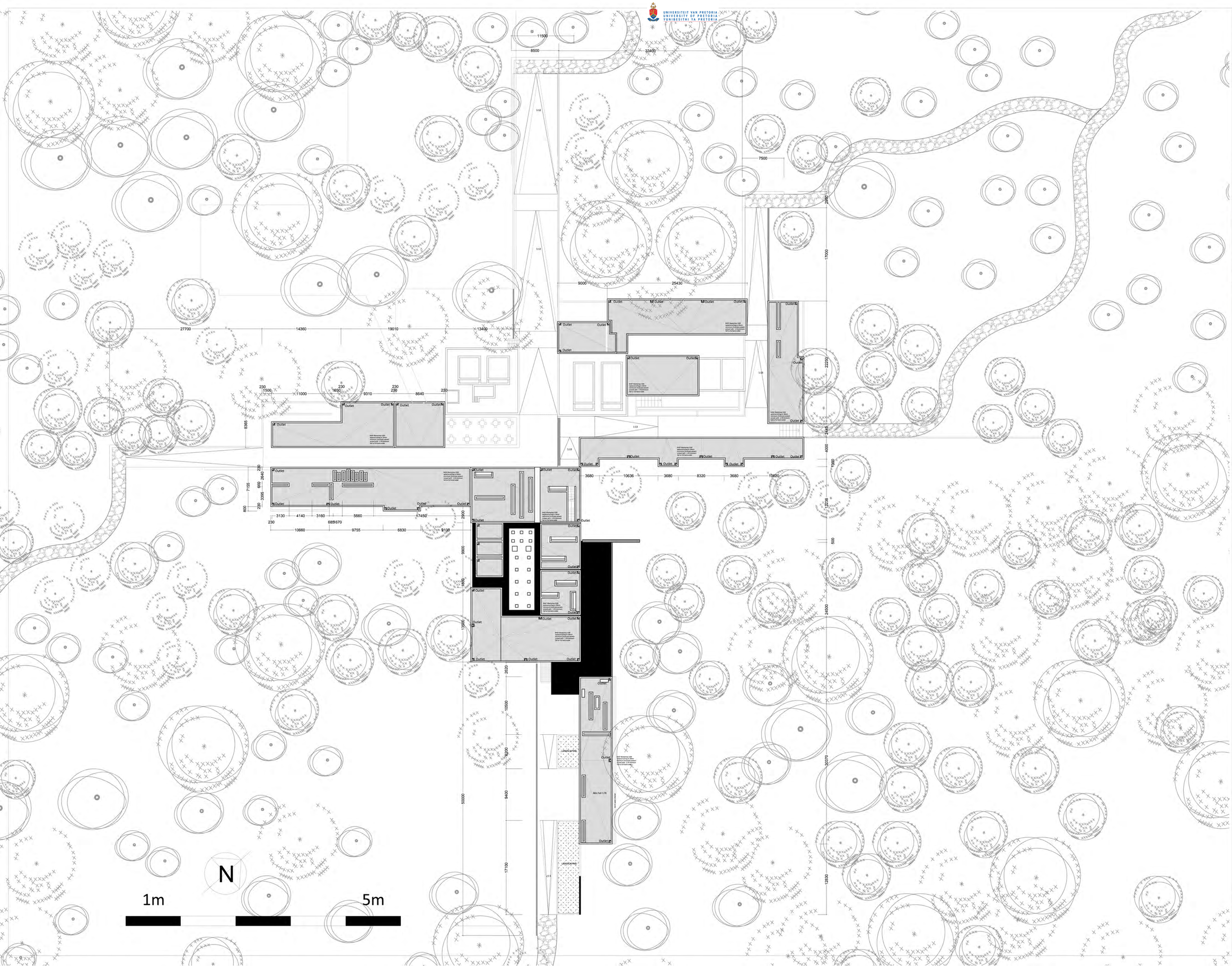

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BASF Mastertop 1330 waterproofing on 20mm minimum thickness cement screed with 1:70 minimum fall to full bore outlet

Mechanically prepare all concrete surfaces to ensure optimum adhesion. All surface repairs to be carried out using the Concresive and Emaco concrete repair ranges.
Prime the surface with one coat Mastertop Primer 2 and apply Mastertop TC 458 top coat, all as included in Mastertop 1330 deck coating system. Applied in accordance with approved BASF s[pecifications by approved applicators.

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE

ROOF PLAN

SCALE	DATE
REFER TO BAR SCALE	2009.11.25

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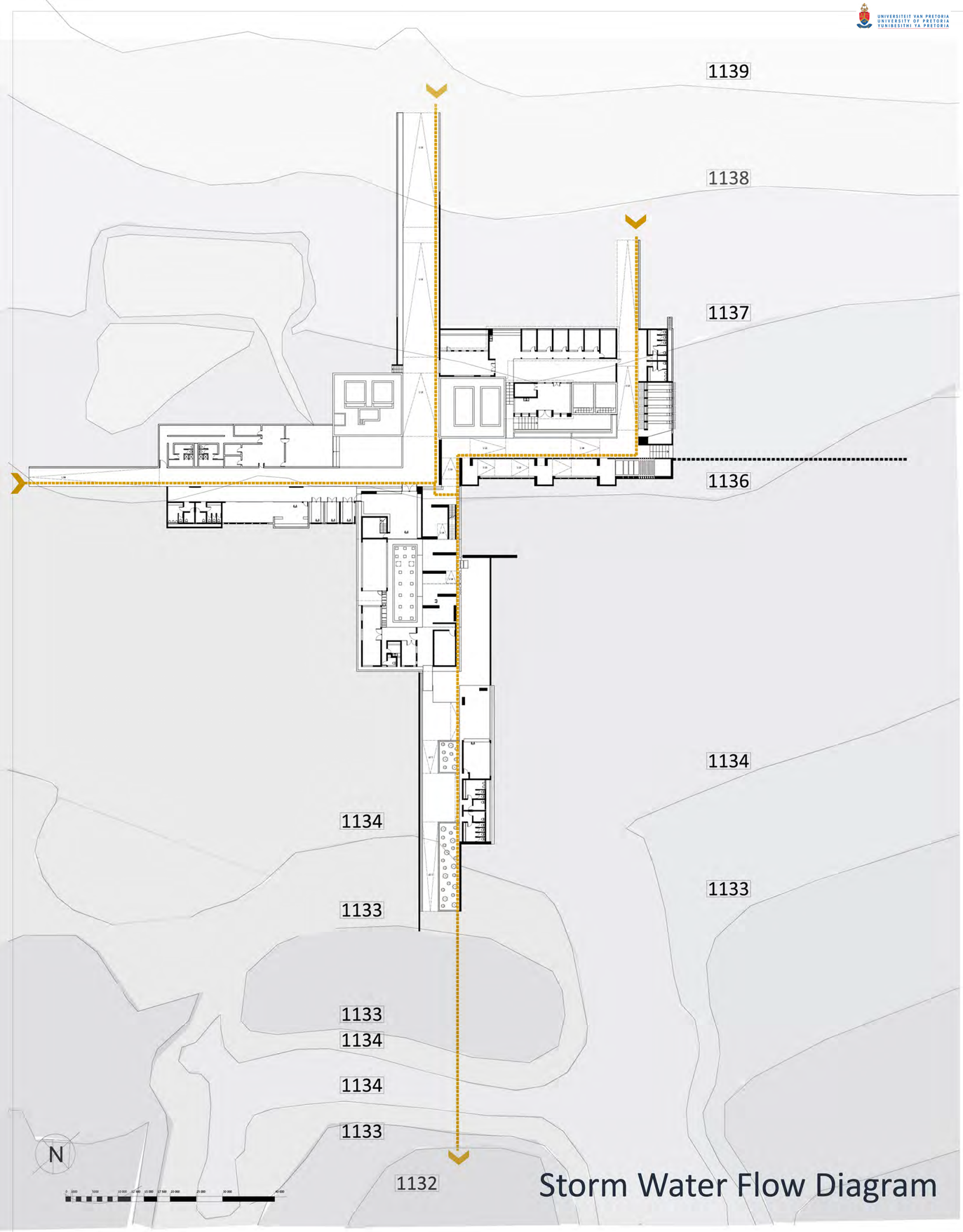
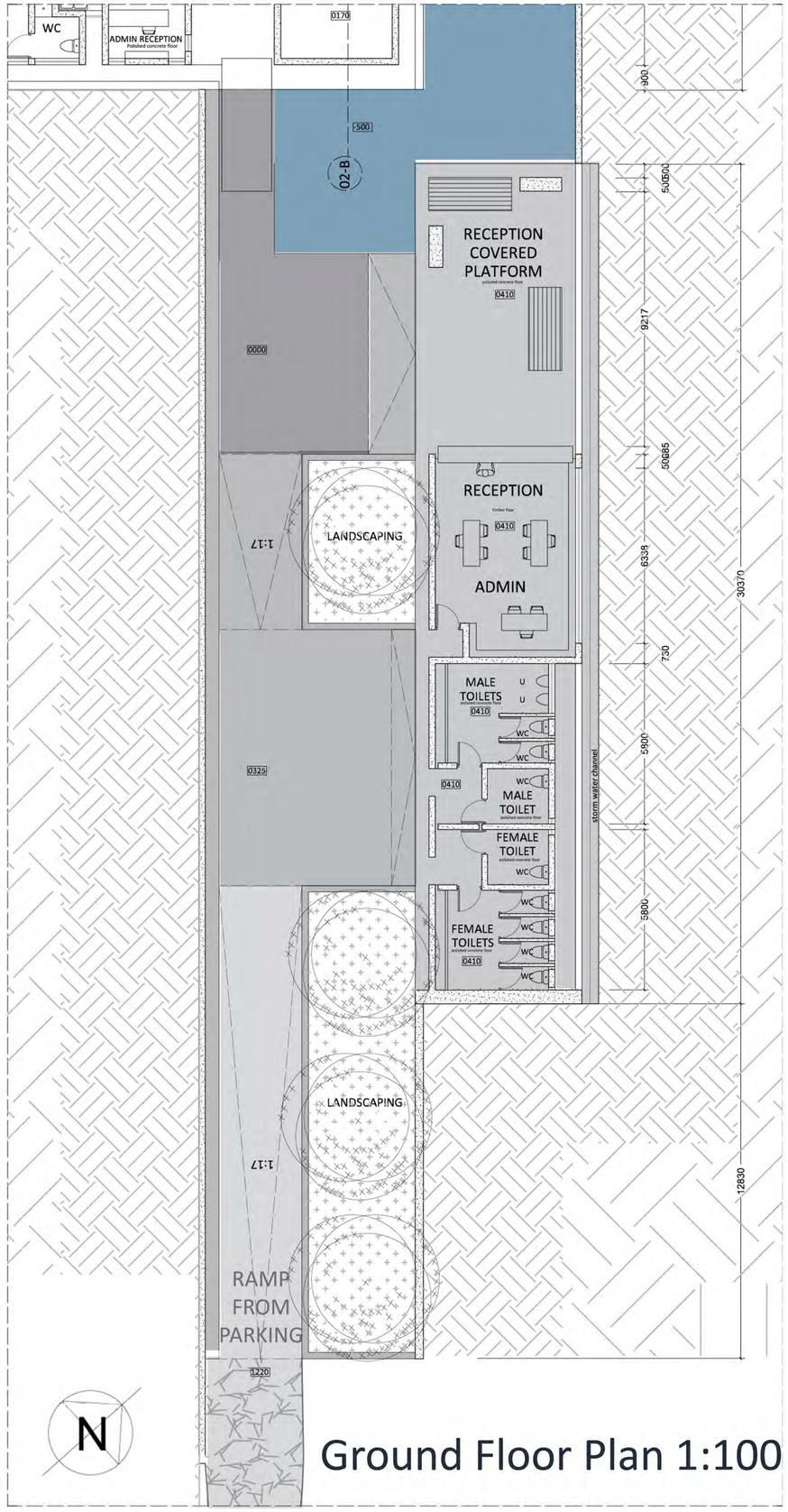


Storm Water Flow Diagram



Ground Floor Plan 1:100

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KEY PLAN

LEGEND

- LEVEL 0000
- LEVEL 0170 - 0400
- LEVEL 0400
- LEVEL 0400 - 1600
- CHLORINATED WATER
- NEW BACKFILL
  [APPROX. 1.4M DEEP ON AVERAGE]

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE

STORM WATER FLOW DIAGRAM
SELECTED PLAN [1]

SCALE 1:100
REFER TO BAR SCALE
DATE 2009.11.25

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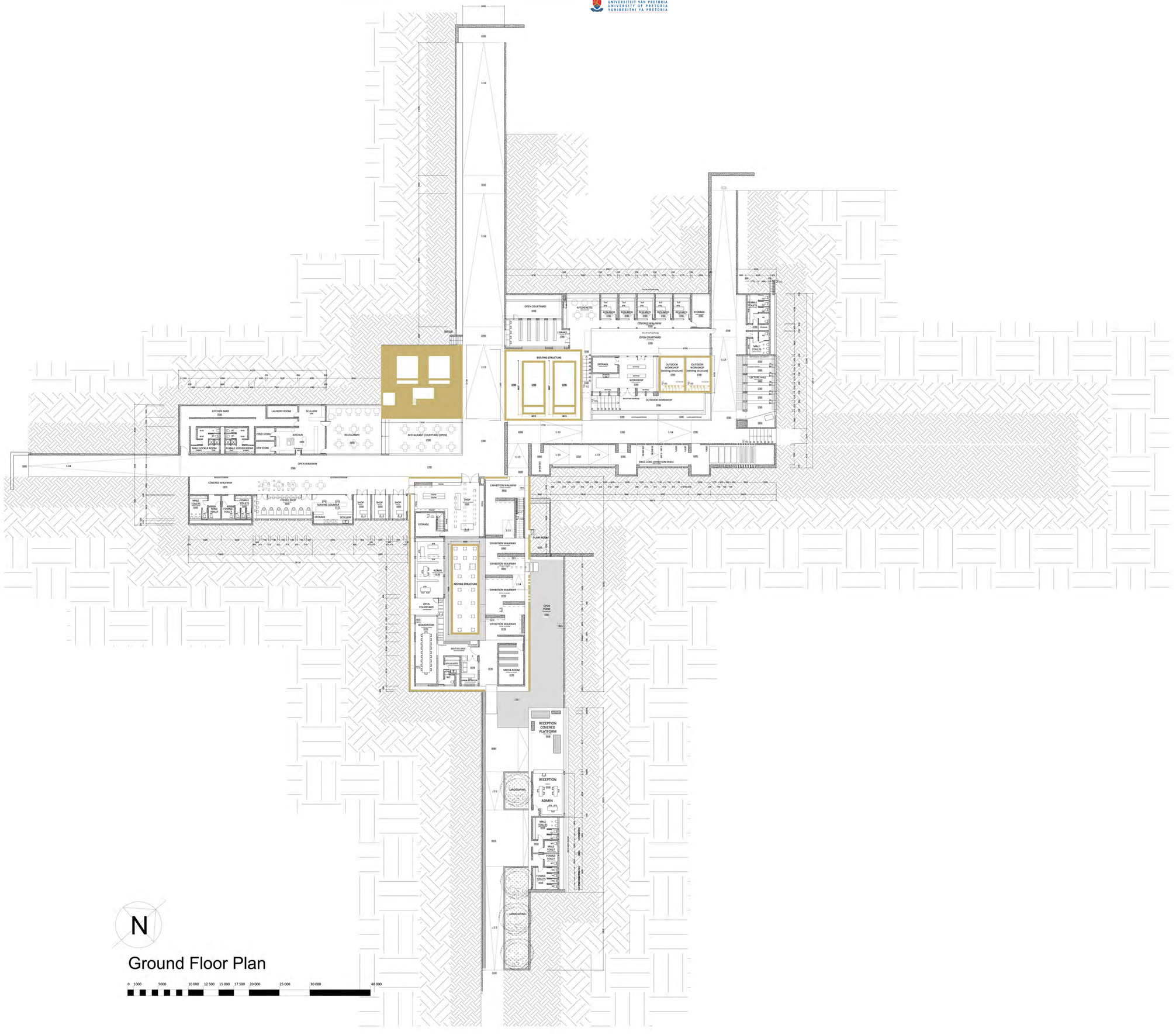

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LEGEND

EXISTING STRUCTURE

MANIFESTING THE MEMORY

A MEMORIAL FOR A METEORITE

PLAN

SCALE	DATE
REFER TO BAR SCALE	2009.11.25
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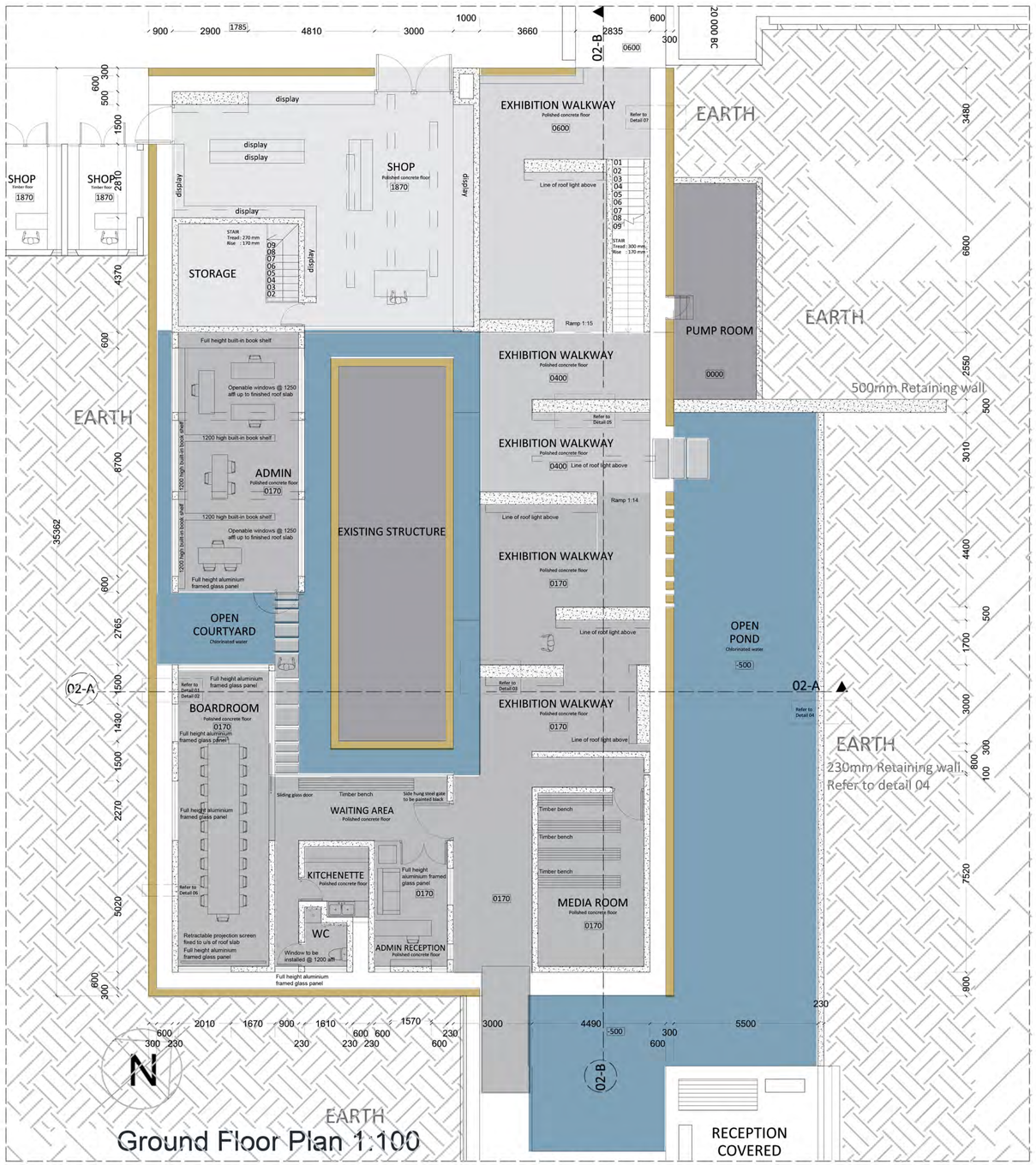

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KEY PLAN

LEGEND

- LEVEL 0000
- LEVEL 0170
- LEVEL 0400
- LEVEL 0600
- LEVEL 1870
- CHLORINATED WATER
- EXISTING STRUCTURE
- EXISTING EARTH
- BACKFILL [APPROX. 2.4M DEEP ON AVERAGE]

Notes: The selected plan illustrates the water features, with the related pumps, pipe systems, directional flow and overflow points. The sewage is directed towards a septic tank that is connected to a french drain on the site. The storm water is directed away from the structures as illustrated on the storm water diagram. The plan also illustrates the floor patterns as discussed in Chapter 06:21. Details 2, 3 and 7 illustrate the concept associated with the construction of the floor.

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SELECTED PLAN [2]
SERVICES PLAN

SCALE	DATE
1:100	2009.11.25

DRAWN: ANJA BREDELL 23337550

DRAWING NO.: 005

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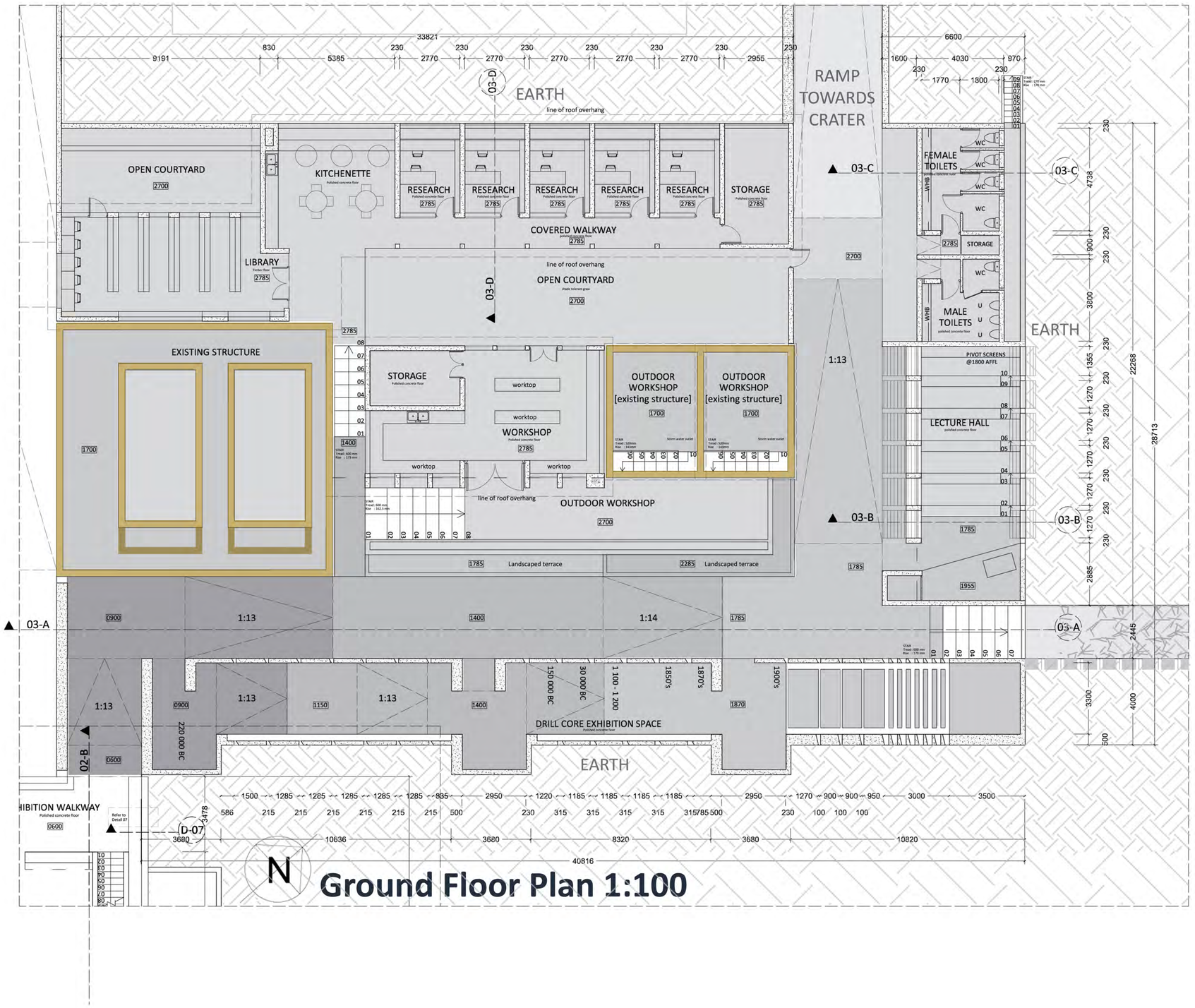

Ground Floor Plan 1:100

NOTES

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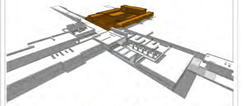

KEY PLAN

LEGEND

- LEVEL 0600 - 1150
- LEVEL 1400
- LEVEL 1700
- LEVEL 2700
- LEVEL 2700 +
- EXISTING STRUCTURE
- EXISTING BACKFILL [APPROX. 1.8M DEEP ON AVERAGE]

Note: The drill core will be exhibited as one of the main elements of the exhibition, representing the timeline of the events that took place on the site, with the appropriate exhibitions accomponying the exhibited drill core levels

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SELECTED PLAN [3]

SCALE	DATE
1:100	2009.11.25

DRAWN: ANJA BREDELL 23337550

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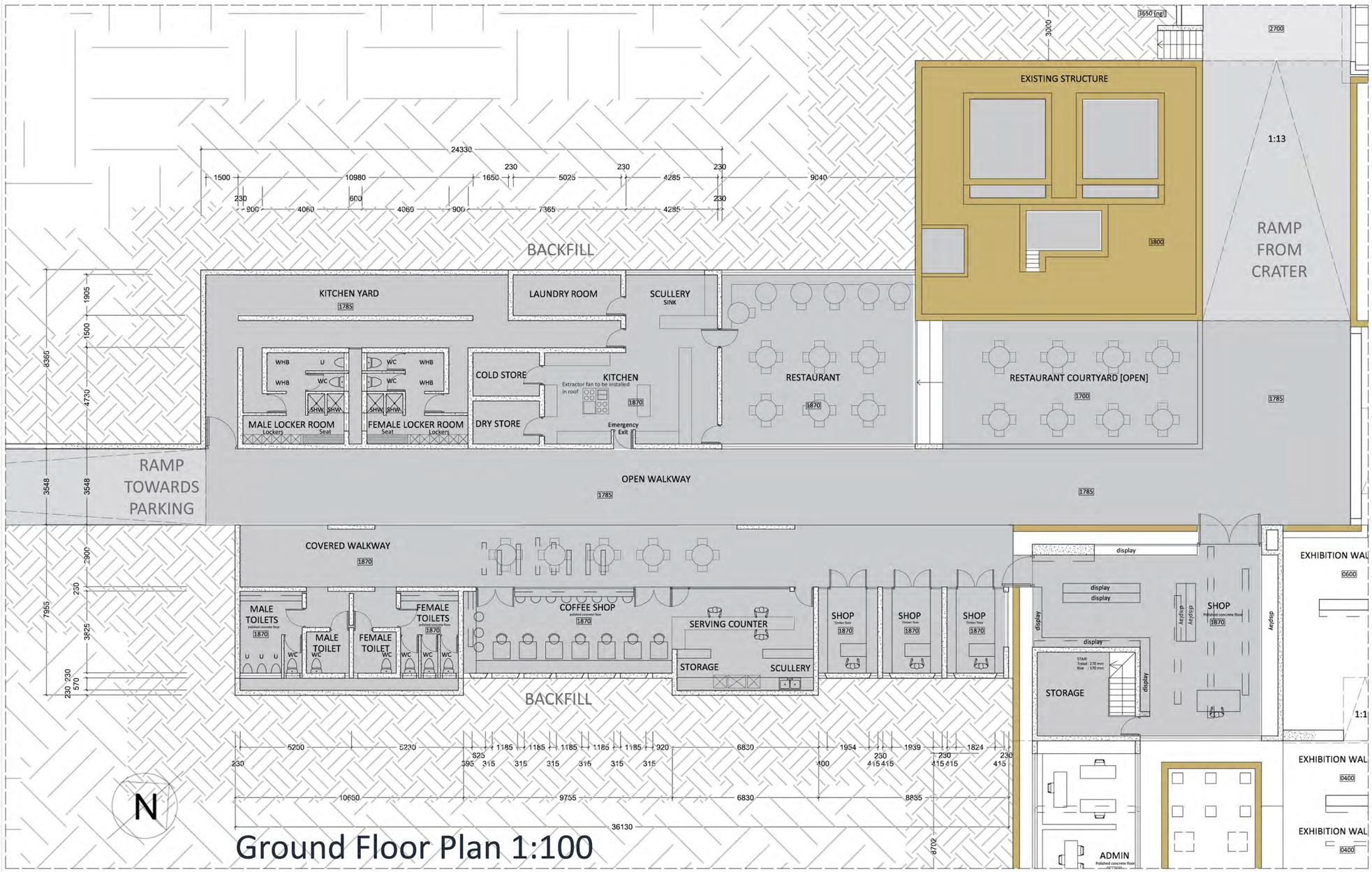

Ground Floor Plan 1:100

NOTES

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KEY PLAN

LEGEND

- LEVEL 1700
- LEVEL 1700 - 2700
- LEVEL 2700 +
- EXISTING STRUCTURE
- NEW EARTH BACKFILL [APPROX. 1.6M DEEP ON AVERAGE]

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SELECTED PLAN [4]

SCALE	DATE
1:100	2009.11.25

DRAWN: ANJA BREDELL 23337550

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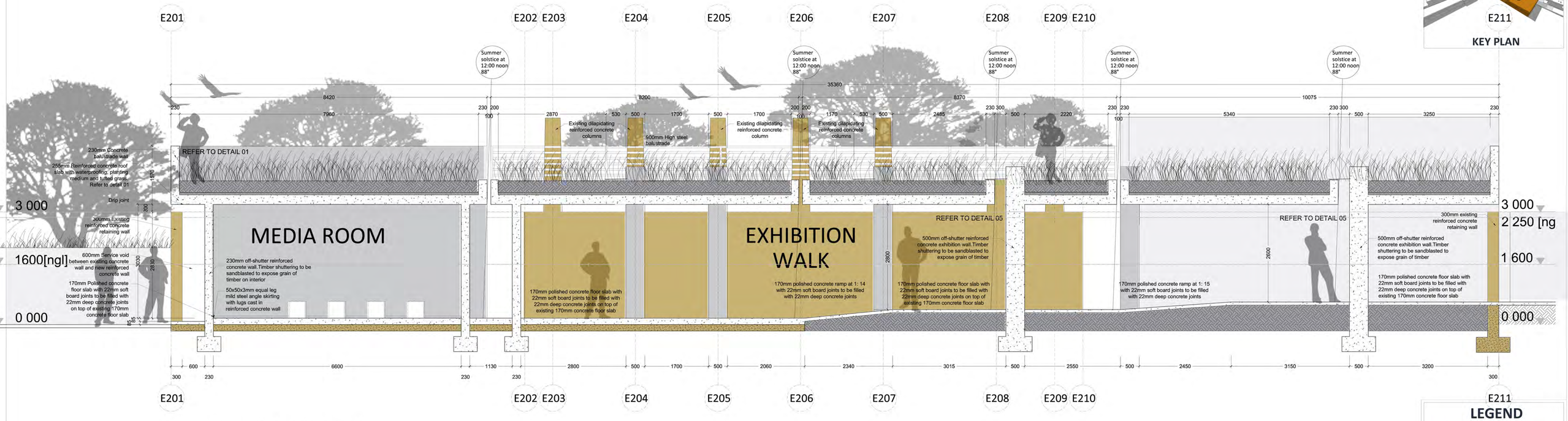
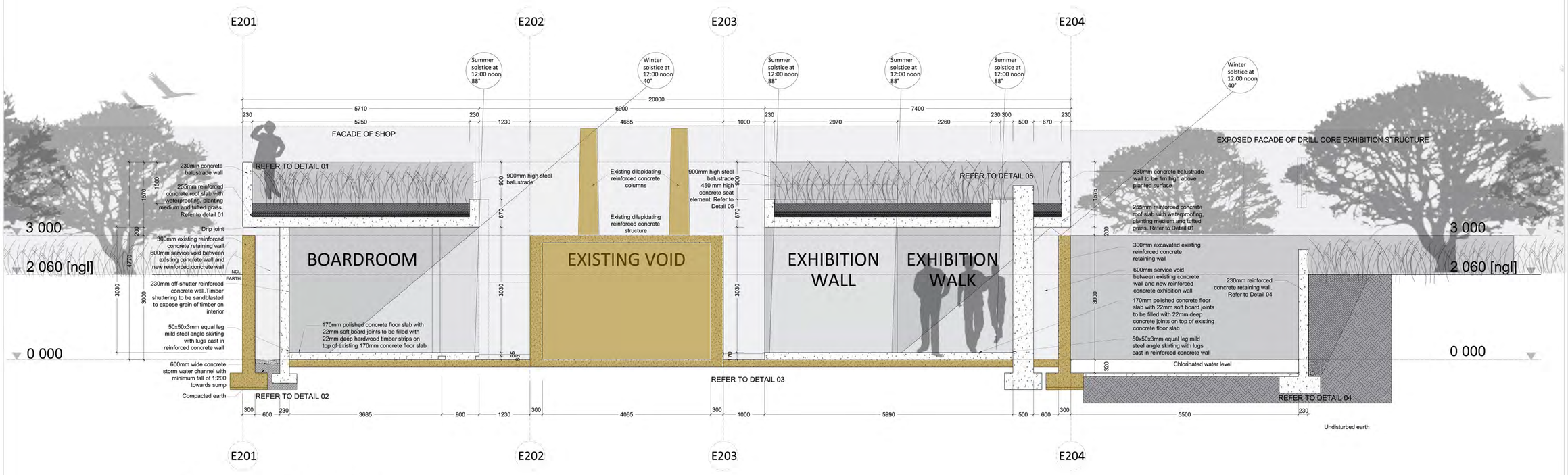


Section 02-B 1:50



Section 02-A 1:50

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SECTIONS

LEGEND

EXISTING STRUCTURE

SCALE	DATE
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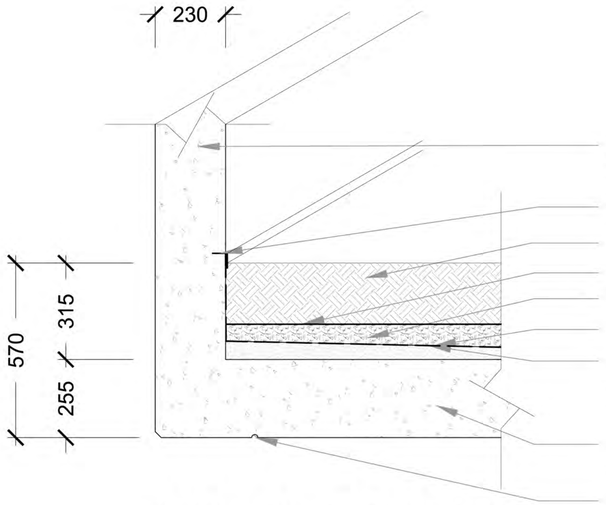
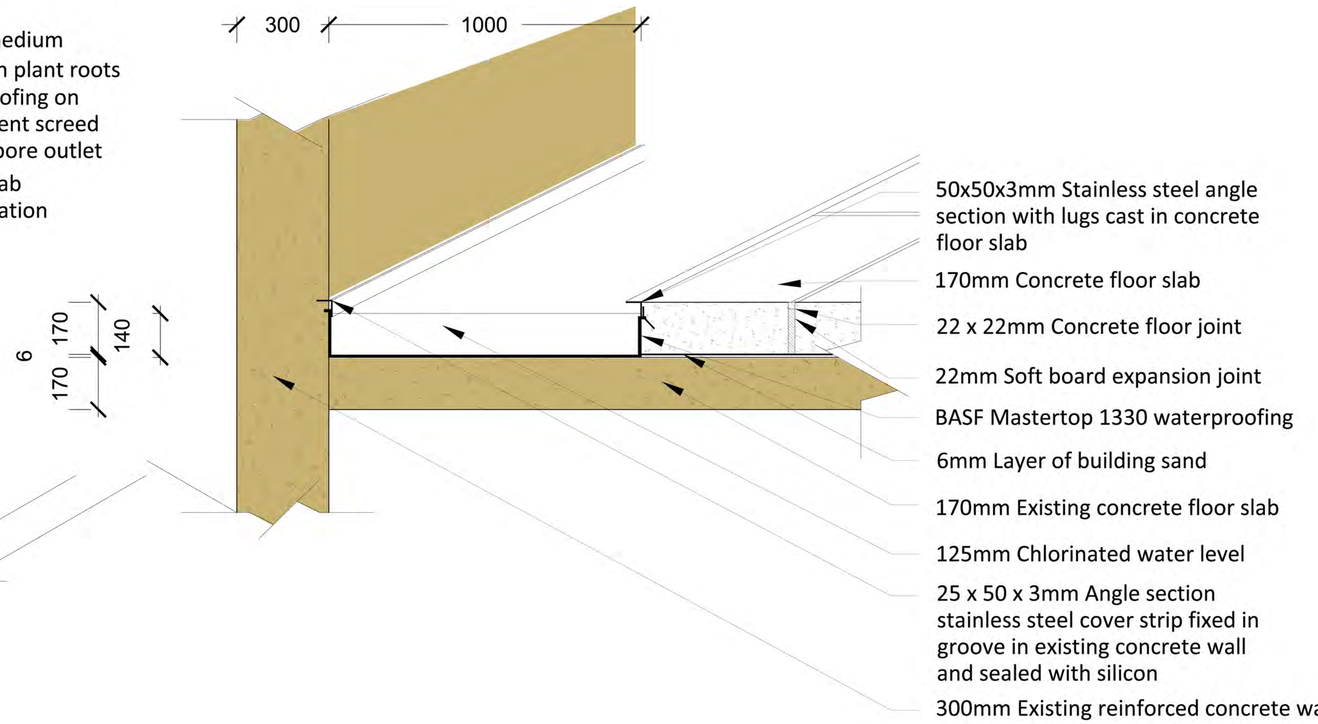
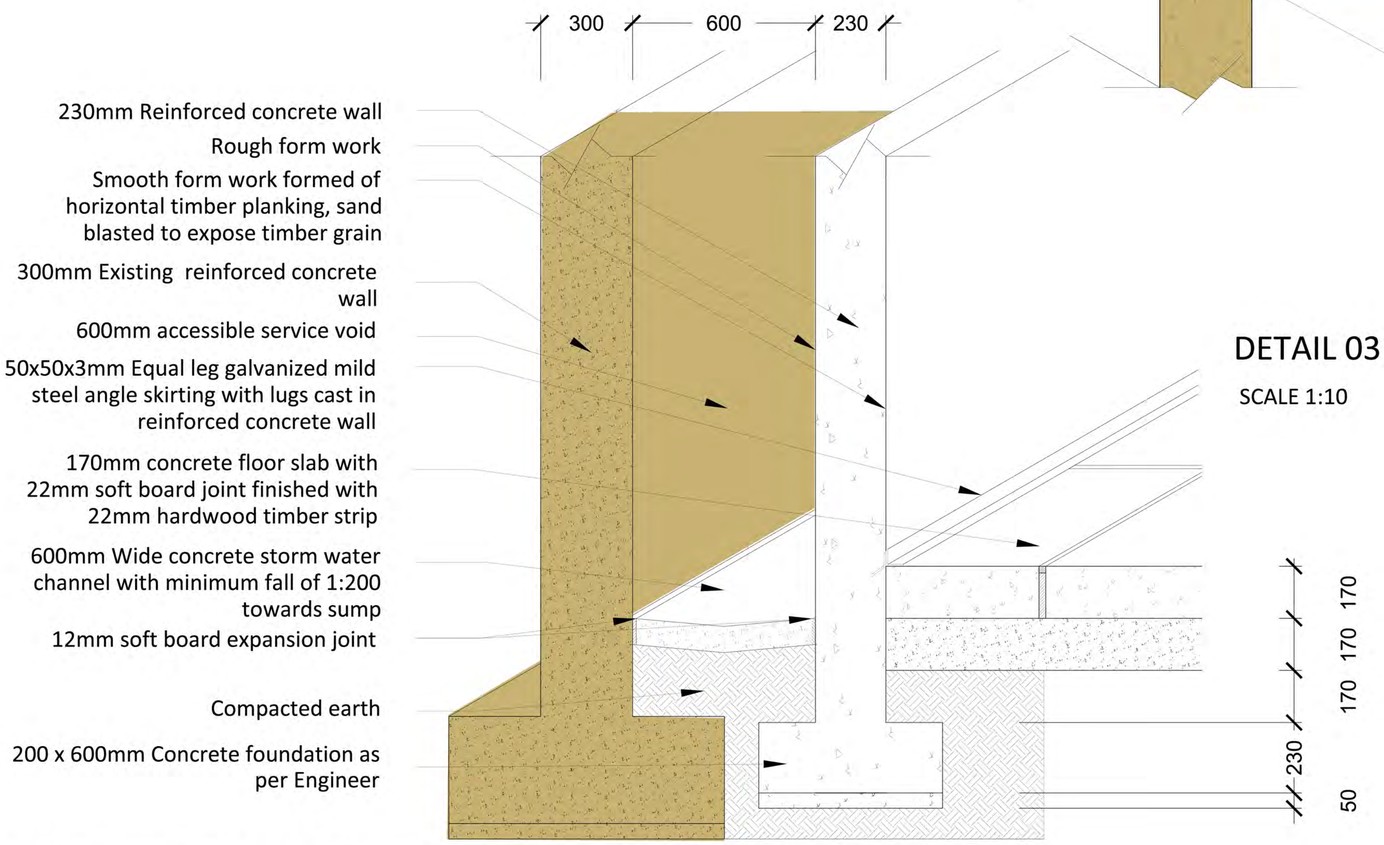


DETAIL 01: GREEN ROOF
SCALE 1:10



DETAIL 03: NEW FLOOR WITHIN EXISTING CONTEXT
SCALE 1:10



DETAIL 02: SERVICE VOID BETWEEN NEW AND EXISTING STRUCTURES
SCALE 1:10

NOTES

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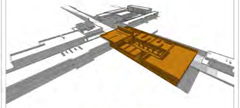


KEY PLAN

LEGEND

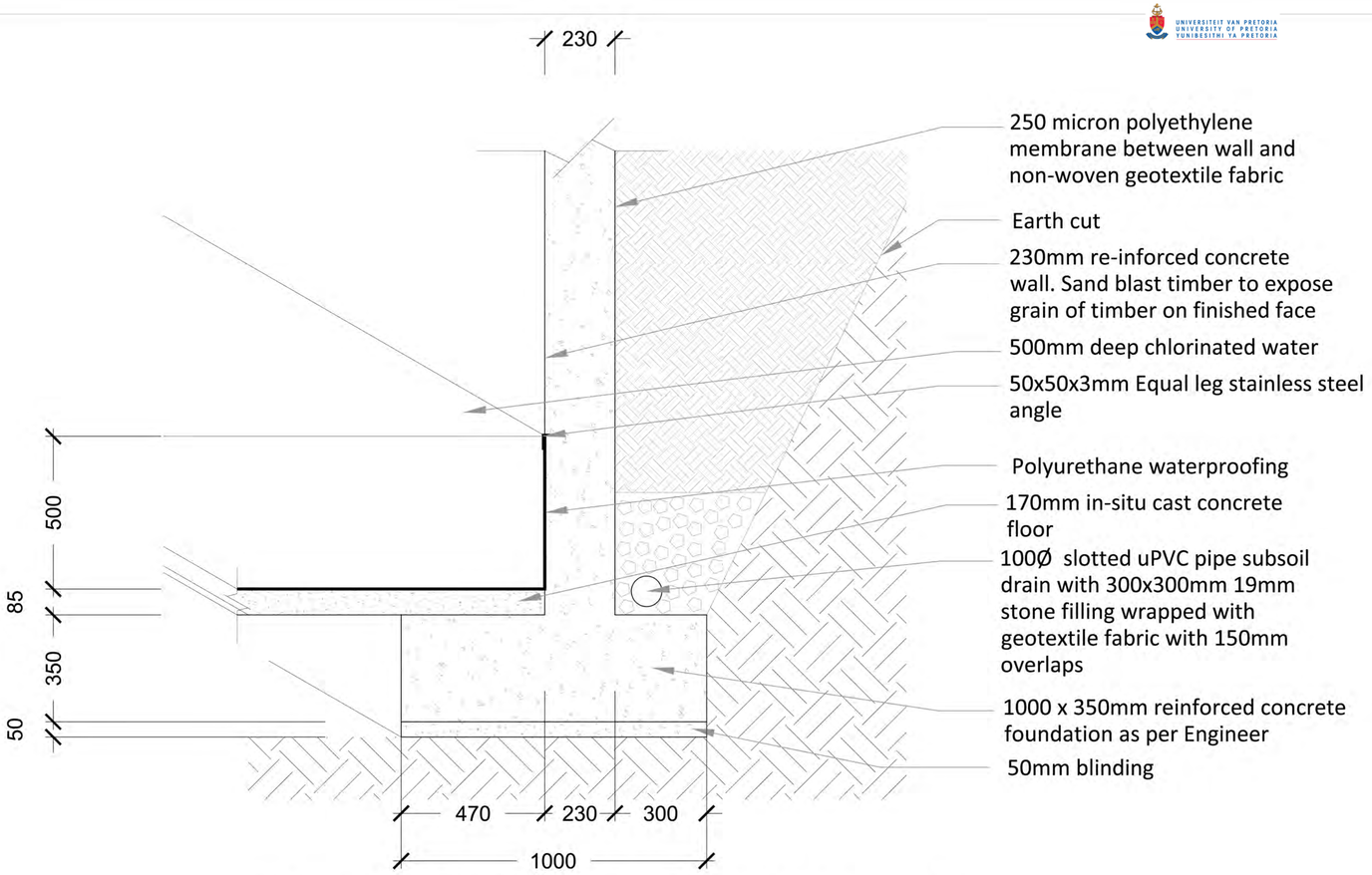
EXISTING STRUCTURE

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
DETAILS

SCALE	DATE
1:10	2009.11.25

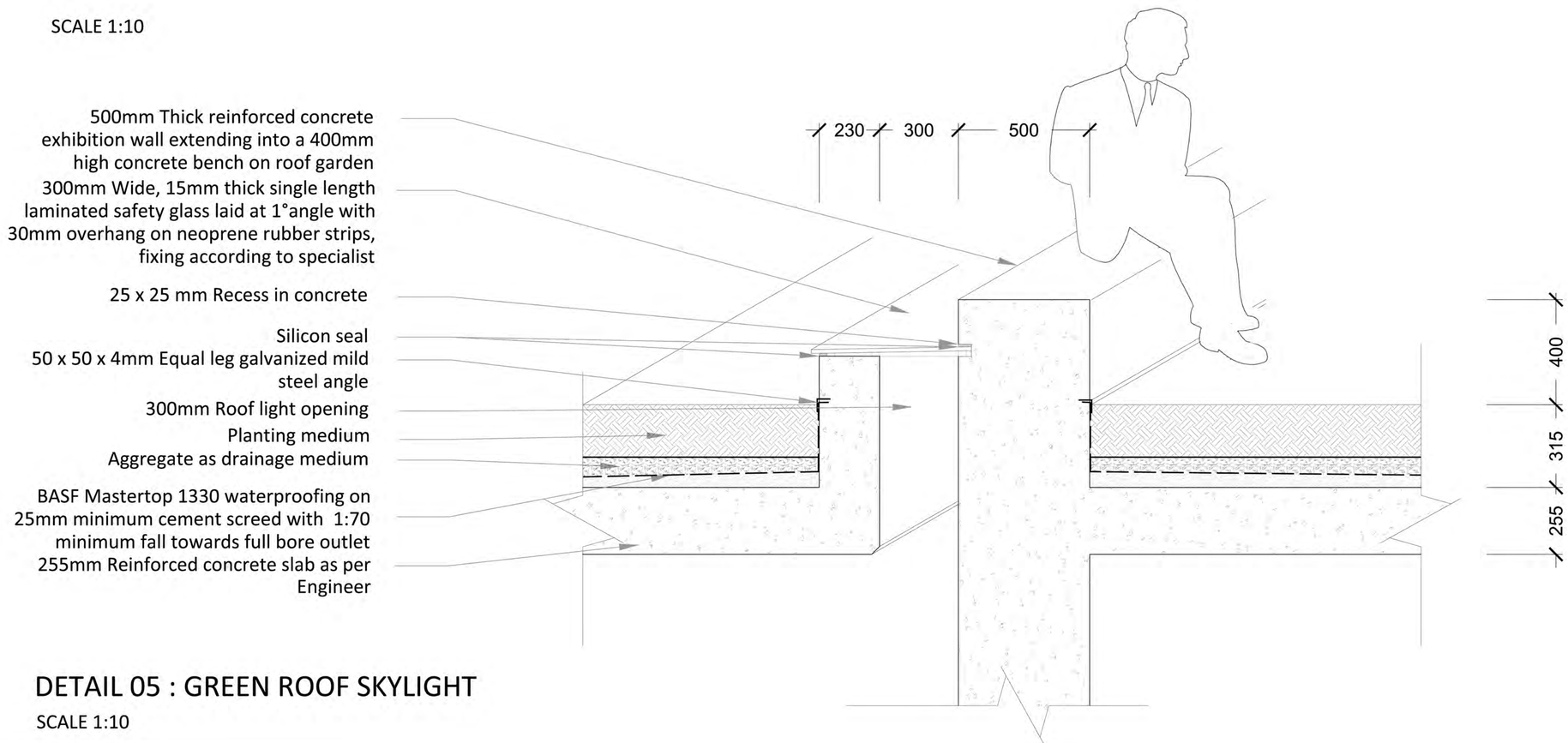
DRAWN: ANJA BREDELL 23337550

DRAWING NO.: 009



DETAIL 04 : REINFORCED CONCRETE RETAINING WALL

SCALE 1:10



DETAIL 05 : GREEN ROOF SKYLIGHT

SCALE 1:10

NOTES

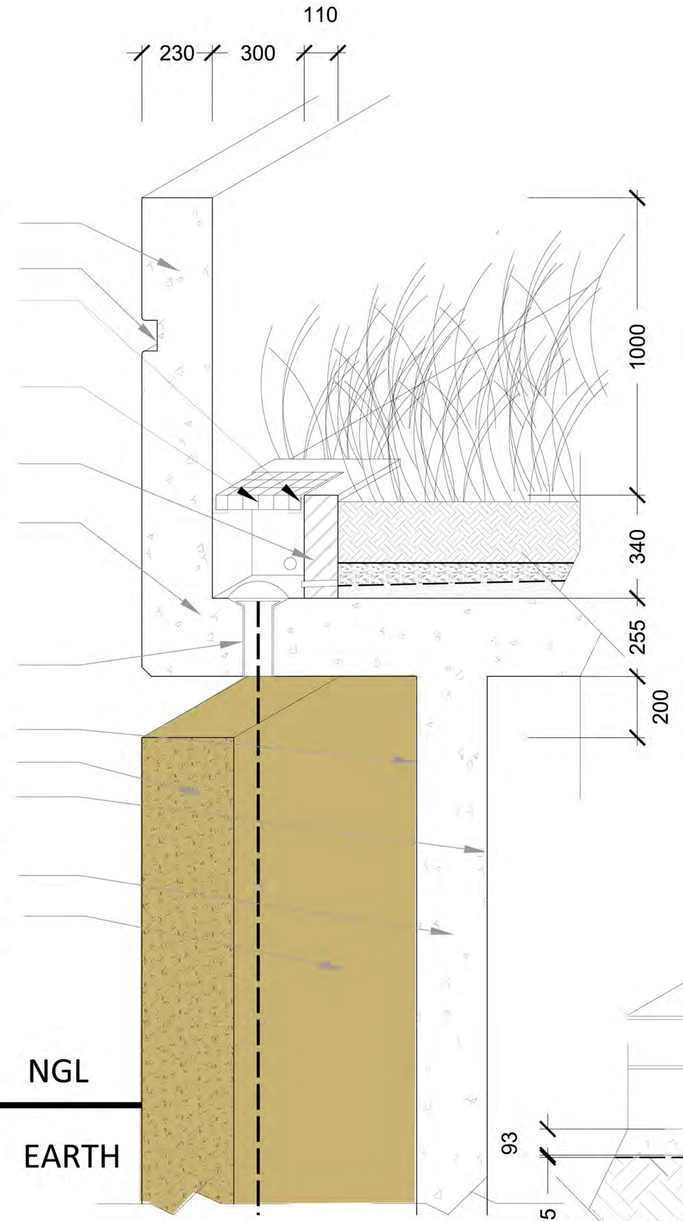
KEY PLAN

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
DETAILS

SCALE	DATE
1:10	2009.11.25

DRAWN: ANJA BREDELL 23337550

DRAWING NO.: 010



230mm Concrete balustrade wall

50x100mm Recessed shadow line

50 x 50 x 4mm Equal leg galvanized mild steel angle fixed to existing concrete wall with M10 chemical anchors

100 x 40 x 40 B60mm Galvanized mild steel Andrew Mentis gripweld grating

110mm Brick wall,finish with plaster on all exposed faces, 20mm Ø uPVc pipes at 100mm centres allround

255mm Reinforced concrete roof slab with waterproofing, planting medium and tufted grass. Refer to green roof detail 01

100 Ø Full bore outlet with chain attached to full bore cover

Rough form work

300mm Existing reinforced concrete wall

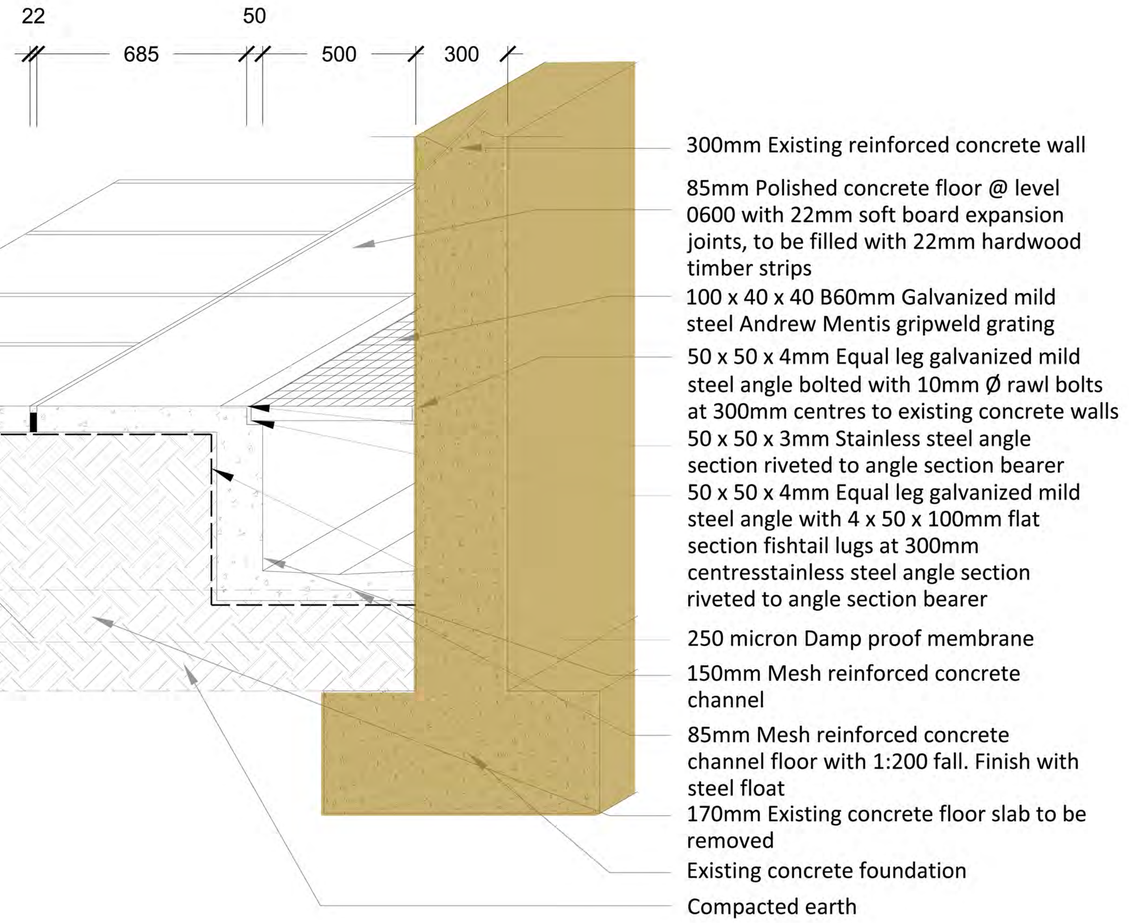
Smooth form work formed of horizontal timber planking, sandblasted to expose timber grain

230mm Reinforced concrete wall

600mm Service shaft between new and existing walls

DETAIL 06: STORM WATER OUTLET FROM GREEN ROOF

SCALE 1:10



300mm Existing reinforced concrete wall

85mm Polished concrete floor @ level 0600 with 22mm soft board expansion joints, to be filled with 22mm hardwood timber strips

100 x 40 x 40 B60mm Galvanized mild steel Andrew Mentis gripweld grating

50 x 50 x 4mm Equal leg galvanized mild steel angle bolted with 10mm Ø rawl bolts at 300mm centres to existing concrete walls

50 x 50 x 3mm Stainless steel angle section riveted to angle section bearer

50 x 50 x 4mm Equal leg galvanized mild steel angle with 4 x 50 x 100mm flat section fishtail lugs at 300mm centresstainless steel angle section riveted to angle section bearer

250 micron Damp proof membrane

150mm Mesh reinforced concrete channel

85mm Mesh reinforced concrete channel floor with 1:200 fall. Finish with steel float

170mm Existing concrete floor slab to be removed

Existing concrete foundation

Compacted earth

DETAIL 07: STORM WATER CHANNEL WITHIN EXISTING CONTEXT

SCALE 1:10

NOTES

ALL RELEVANT DETAILS, LEVELS AND DIMENSIONS TO BE CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORK.
THE ARCHITECT ACCEPTS NO RESPONSIBILITY FOR ERRORS RESULTING FROM MISINTERPRETATION OF THE DRAWINGS.
ALL DIMENSIONS ARE GIVEN IN MILLIMETERS.
FOR INFORMATION ONLY UNLESS OTHERWISE STAMPED & SIGNED.

KEY PLAN

LEGEND

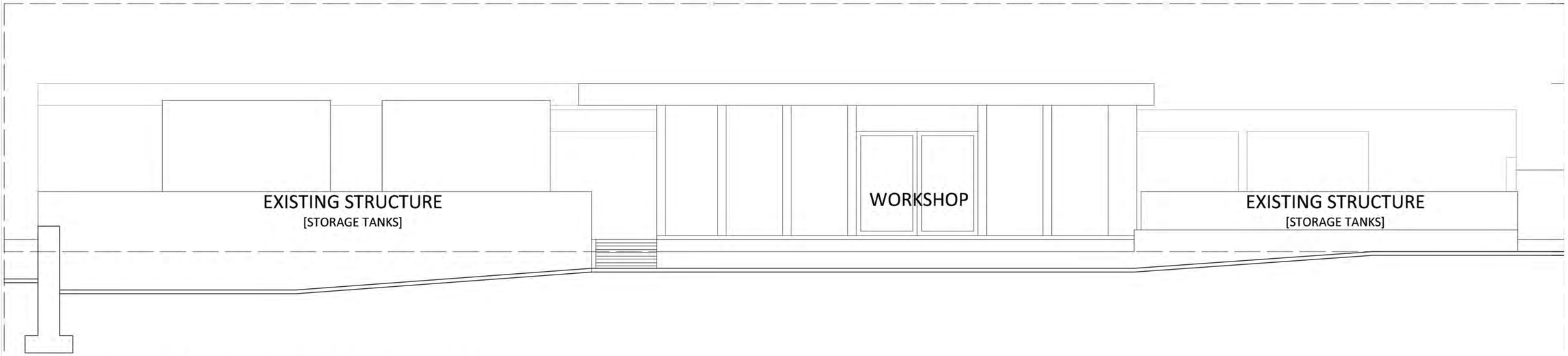
EXISTING STRUCTURE

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
STORMWATER DETAILS

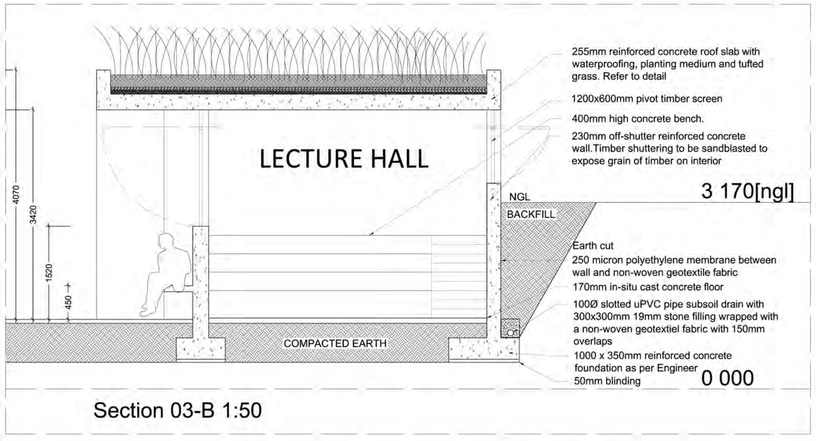
SCALE	DATE
1:10	2009.11.25

DRAWN: ANJA BREDELL 23337550

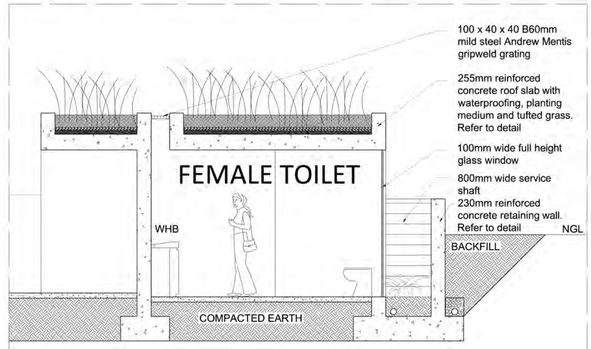
DRAWING NO.: 012



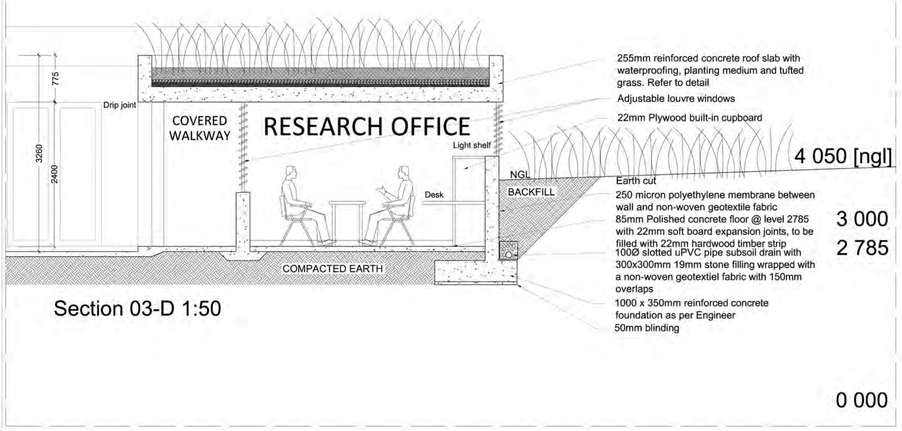
Sectional elevation 03-A 1:100



Section 03-B 1:50



Section 03-C 1:50



Section 03-D 1:50

NOTES

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KEY PLAN

LEGEND

EXISTING STRUCTURE

MANIFESTING THE MEMORY
A MEMORIAL FOR A METEORITE
SECTIONS

SCALE	DATE
1:50	2009.11.25

DRAWN: ANJA BREDELL 23337550

DRAWING NO.: 008

CONCLUSION

Christian Norberg-Schulz emphasises the idea that dwelling satisfies the need for belonging and participation. Architecture is the concrete facilitator of dwelling, enabling human beings to experience a sense of being. The role of architecture extends far beyond basic shelter. Architecture influence lives on a daily basis, and this proposal illustrates its role in protecting cultural heritage by remembering a past and facilitating a future.

With technology as a potential threat to public spaces, the emphasis of architecture needs to shift to the experience of the visitor, an experience that cannot be entertained by the Internet. The project therefore stressed the intangible elements such as sensory exploration and atmosphere as integral to the design solution.

The memorial as building typology may be confused with a space dedicated to silence and contemplation. In contradiction, memory is a live element. Memories are constantly changing as time pass, and it is essential not to focus merely on the past, but on the present and future as well. The 'memorial' should inform future generations of *all* the associated memories. The research facilities integrated in the design was therefore considered as a vital element, to ensure that the site continues to develop as there is much left to discover at this exceptional location.

South Africa's natural and cultural heritage is constantly under threat. The proposed design intervention poses to enable management and sustainable future development by means of research. Financial aid is more likely to be encouraged from both the private and public sector when the site is managed properly and other activities such as invaluable research is conducted. The site is made accessible to the general public, enhancing awareness and education.

Environmental, social and economic sustainability are considered as essential elements to consider when development is proposed. The SBAT system developed by J. Gibberd was used as an assessment tool. The proposal addresses the aspect sustainability in various ways such as the integration of existing structures, minimising the footprint of the development and integrating the local community in a variety of ways. Inclusive design was another fundamental design consideration as all public spaces should be accessible to the general public as a whole. Ramps throughout the design is one example of integrated inclusive design principles.

The existing structures of the historic salt and soda factory is re-utilised, retaining both the physical and metaphysical memory related to the site. The Burra Charter was used as guide to inform design decisions, ensuring the proper protection and integration of the cultural heritage, preserving it for future generations and exposing it to the general public.

The project resulted in an unavoidable integration of the three disciplines, Architecture, Landscape Architecture and Interior Architecture, proving that one cannot be regarded without the other.

In conclusion, the project illustrates that architecture becomes the celebrated meeting place between the old and the new, the past and the future, architecture and the human being.

ACRONYMS

MCDC: Mabopane Centurion Development Corridor

TMC: Tswaing Impact Crater

TOSF: Tshwane Open Space Framework

UNESCO: United Nations Education, Scientific and Cultural Organization

BIBLIOGRAPHY

Adam, H., Paul, J. & Wines, J. 2001 *Architecture Highlights*. London: DuMont

Arte France. 2003. *Architectures 2, The stone thermal baths*. [DVD] . France: Arte France Development

Bachelard, G. 1964. *The Poetics of Space.* Boston: Beacon Press.

Barnes, J. 2009. Verbal communication with Julia Barnes on 21 April. Tswaing Nature Reserve.

Bewsher, P. 2005. Integrated Environmental Management Plan: Tswaing Meteorite Crater. South Africa: Northern Flagship Institute.

Birksted, J. 2000. *Landscapes of memory and experience*. London: Spon Press

Ching, F.D.K. 1996. *Architecture: Form, Space and Order*. New York: John Wiley & Sons, Inc.

Crosbie, M.J 2003. *Designing the World's Best Museums and Art Galleries*. Australia: The Images Publishing Group.

Davey, P. 2002. Battle Lines. Architectural Review. 212[1265], 34-41.

De Jongh, R. 2009. Verbal communication with Dr Robert De Jongh on 16 April. University of Pretoria. [Written notes in possession of author]

Edensor, T. 2005. *Industrial Ruins: Space, Aesthetics and Materiality*. Oxford: Berg.

Escher, M.C. 2006. *M.C. Escher*. London: Taschen.

Finch, P. 2005. Space framed. The artist within. *Architectural Review*. 217[1306], 42-47.

Fletcher, A. 2001. *The Art of Looking Sideways*. London: Phaidon.

Groak, S. 1992. *The Idea of Building: thought and action in the design and production of buildings*. London; New York: E & FN Spon.

Hale, J.A. 2000. *Building Ideas: an introduction to architectural theory*. New York: John Wiley.

Hauptmann, D. & Akkerhuis, B.2006. *The body in Architecture*. Rotterdam: 010 Publishers.

Jodidio, P. 2009. *Green*. Cologne: Taschen.

Kuma, K. 1995 *To see and be seen*. The Japan Architect. Volume 1995/19, 114-127.

Lobell, J. 2000. *Between Silence and Light: Spirit in Architecture of Louis Kahn*. Boston: Shambhala.

Long, K. 2007. *The Monument in the age of political correctness*. Icon. February 2007, 075 - 079

Low, A.B. & Rebelo, A.G. (eds). 1998. *Vegetation of South Africa, Lesotho and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.

Low, I. 2008. Liliesleaf legacy project. Digest of South African Architecture, [13], 042-045.

Metropolitan Planning, Urban Research & Strategic Directions. 2004. Tshwane Metropolitan Profile, A Compendium of Planning Information. Tshwane: Metropolitan Municipality,Department Housing, City Planning & Environmental Management. http://www.tshwane.gov.za/documents/MetropolitanProfile080305.pdf Accessed:15.03.2009

Mmule. 2009. Verbal communications with Mmule, the Tswaing Nature Reserve guide on 14 March. Tswaing Nature Reserve. [Written notes in possession of author]

Muller, L. 2009. Verbal communication with Liana Muller on 17 April, lecturer at the University of Pretoria. University of Pretoria. [Written notes in possession of author]

Murphy, R. 1990. *Carlo Scarpa and the Castelvecchio*. Great Britain: Butterworth Architecture.

Nesbitt, K. 1996. *Theorizing a new agenda for architecture: an anthology of architectural theory*, 1965-1995. New York: Princeton Architectural Press.

Norberg-Schulz, C. 1985. *The concept of dwelling : on the way to figurative architecture*. New York: Rizzoli

Orton, A. 1994. *The way we build now: form, scale and technique*. London: Spon Press.

Pallasmaa, J. 2005. *The eyes of the skin: Architecture and the senses.* Great Britain: Wiley-Academy.

Perkins, S. 1995. *Experience*. London: Booth-Clibborn Editions.

Pretoria Art Museum. February 2009. *In die sterre geskryf ll [Written in the stars ll]:An installation piece by Berco Wilsenach* [Press release]. Pretoria.

Rasmussen, S.E. 1962. *Experiencing architecture*. Cambridge: M.I.T. Press.

Reimold, W.U., Brandt, D., De Jongh, R. & Hancox, J. 1999. *The Tswaing Meteorite Crater: An introduction to the natural and cultural history of the Tswaing region including a description of the hiking trail*. Wits University: Council of Geoscience.

Reimold, W.U. 2002. Meteorites and Meteorite Craters Johannesburg: University of the Witwatersrand, Department of Geology. www.saao.co.za. Accessed: 24.02.2009

Ruhrberg, K. & Walther, IF. 1998 *Art of the 20th century*. Volume 2. Cologne: Taschen

Ruskin, J. 1849 *The seven lamps of architecture*. London: J.M. Dent & Sons.

Stewart, M. 2002 *Launching the Imagination*. New York: McGraw-Hill

The Dictionary Unit For South African English. 2002. *South African Concise Oxford Dictionary*. South Africa: Oxford University Press Southern Africa [Pty] Ltd

Thompson, M.W. 1981. *Ruins: Their preservation and Display*. London: British Museum publications.

Trent Concrete. 2008. *Centre for Contemporary Arts Nottingham* .www.trentconcrete.co.za. Accessed:09.09.2009

Tshwane Municipality. 2005. Tshwane Open Space Framework. Tshwane: The Department

United Nations Education, Scientific and Cultural Organization. 1972. *Convention concerning the Protection of the World Cultural and Natural Heritage.* Paris: General Conference

A Unique Project. www.kalkriese-varusschlacht.de/index/getlang/en. Accessed: 11.08.2009

Zumthor, P. 2006. *Thinking Architecture*. Boston: Birkhauser

ADDENDA

8.1 Tswaing Framework: Site analysis

Problems + Constraints

o Close to Soshanguve
o The site is affected by the air, light and water pollution from the informal settlement.
o Environmental degradation is caused by the exploitation of natural resources such as water and firewood.
o Poverty in the informal settlements may lead to security problems.
o Future expansion of informal settlement may threaten the conservation area.
o Environmental degradation such as erosion
o Mismanagement
o Unskilled labour

Opportunities

o The planned Mabopane-Centurion Development Corridor as well as the upgrade of public transportation to Soshanguve will improve the accessibility and exposure of the site.
o The informal settlement provides the opportunity of a local workforce that can benefit from skills transfer on the construction site.
o The significance of the site makes the site marketable as a destination for foreign visitors that bring capital injection.
o The proximity of the site to the city enables local visitors easy accessibility.
o Although close to the city, the site lies outside the urban edge and thus has a rural character.
o The history of experimental farming and other activities on the site may be an indication of possible future endeavors.
o Astereological studies can be performed on the site and could attract specialist researchers.
o The unique nature of the site suggests it as a World Heritage site. This promotes it as an eco-tourism destination and could attract external funding.

Potential projects/opportunities

The above problems and opportunities suggest some potential projects:
o Eco-tourism: nature reserve, hiking, bird watching, entomology
o Education: astronomy, ecology. This can either be for day visitors or programs that extend over periods of time.
o Retreat or contemplation space.
o Research facility
o Overnight accommodation [middle to upper-class]

8.2 Tswaing Framework: Proposal

The framework suggests that the Tswaing Crater is to be protected, used, developed, conserved, managed and controlled in a sustainable and appropriate manner. It is important to ensure that the utilisation of the Tswaing Crater is efficient, sustainable and beneficial to all the relevant parties associated and involved with the site. It is of great importance that social and economic development is accommodated. It is also of importance that the facilities and management of the site is equitable on a national and international level within the African context.The following key areas have therefore been identified

1. Community link

This area is located directly across the small existing Soutpan community. There are no available services such as water and electricity currently available in within this community. The allocated area in the framework is the current location of the visitor centre where visiting guests pay admission fees and a scale model of the site can be viewed. Toilet facilities are also available in the building. The proposal is to remove the current function of 'visitor centre' from the allocated area and relocate it within the fenced site boundaries. It is therefore suggested that these existing facilities are integrated with the immediate community (the Soutpan community) and that the utilisation and management of the facilities will be monitored by the Tswaing Crater Museum authorities, while at the same time, an opportunity for education and economic development is integrated into the community.

2. Entrance

This is currently the main entrance to the conservation area. The proposal is therefore to formalise this entrance, and combine some of the previous functions from the visitor centre such as entry fees and information brochures with the new facility.

3. Educational/accommodation

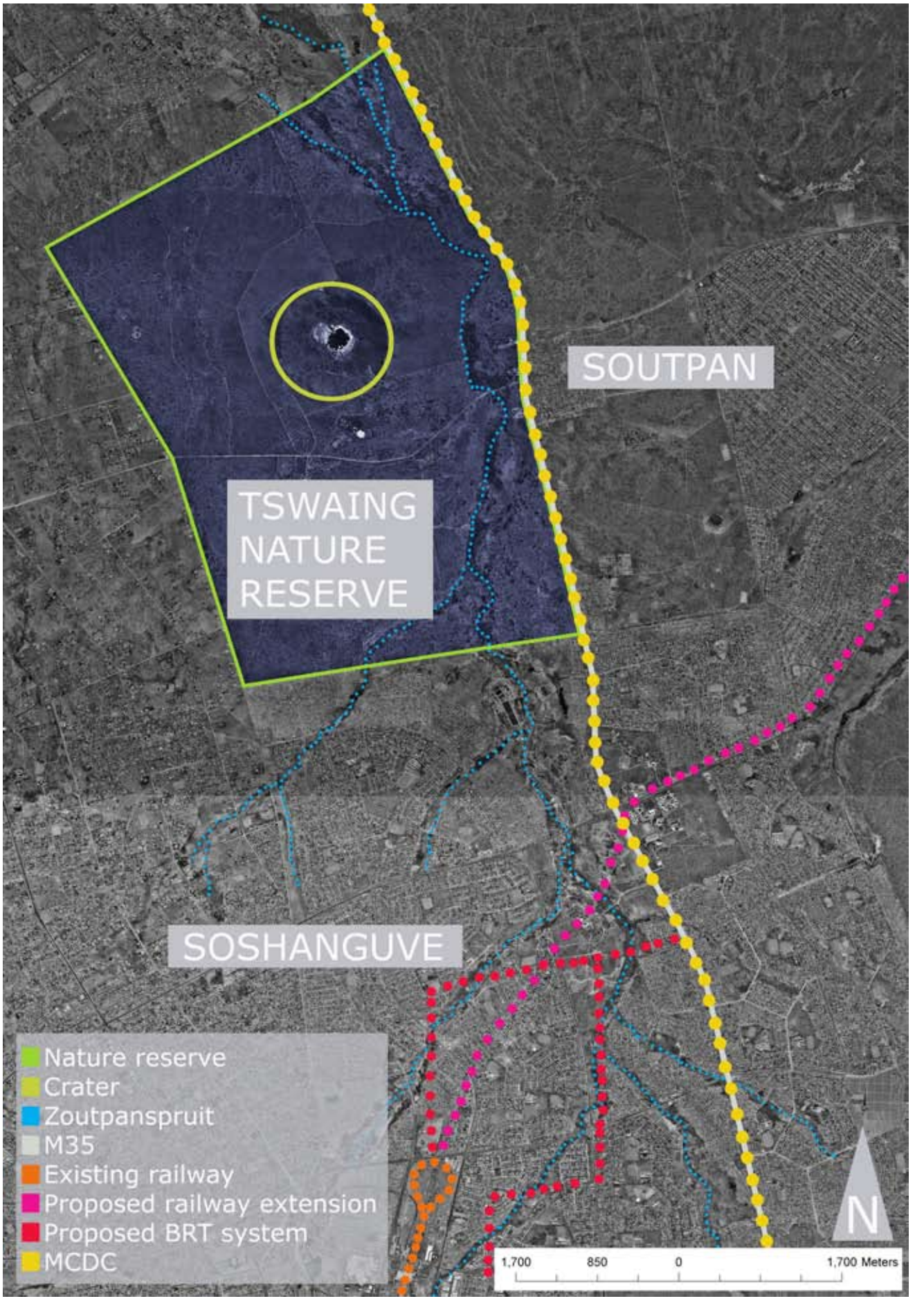
The Kgotla is currently situated here. The suggestion is to retain it and its associated function of accommodation in this area. It is also proposed to integrate the educational aspect of the site into this area as the target group for these specific facilities will be school groups and other large groups.

4. Research/accommodation

This area will potentially be linked with the Kgotla. The difference will however be that these facilities will accommodate smaller groups or individuals interested in the research fields associated with the site or visitors that wish to stay overnight for recreational purposes.

5. Staff facilities

The staff will be accommodated with all the related amenities that they should need in this part of the site. The existing structures were initially used as the reception area of the site, and are currently used by security staff members. There is also a picnic site and ablution facilities that will be integrated into the proposal for the staff housing.


SOUTPAN
TSWAING
NATURE
RESERVE
SOSHANGUVE
Nature reserve
Crater
Zoutpanspruit
M35
Existing railway
Proposed railway extension
Proposed BRT system
MCDC
N
1,700
850
0
1,700 Meters

6. Public area

This area will be dedicated to all the related public facilities such as a parking area, an area for refreshment, recreation, information and education. These amenities will be accessible to the general public.

7. Semi-public area

This part of the site will be accessible to the interested parties.

8. Open interpretation

The development or intervention in crater is open to interpretation, and each individual student will define the parameters as is appropriate with each scheme.

Pedestrian routes

These routes are dedicated to pedestrian movement only. The routes will be formalised to facilitate and encourage pedestrian activity.

Protected wetland + Soutpanspruit

The sensitive wetland area and Soutpanspruit are regarded as areas that will be protected with environmental and ecological management.

Controlled vehicle access route

These routes will only be accessible to vehicles with authorisation. These include for example, staff, management and authorised visitors that need vehicular access to the semi-public area.

Main vehicle route

This route will be formalised and accessible to all vehicles permitted through the entrance gate.

8.3 Soda-ash and salt extraction

Soda-ash production

1. Soda-salt liquid [brine] was pumped from the boreholes in the crater floor with electric pumps. The brine that was collected was brought to temporary reservoirs at a central pumping station next to the old wagon road.

2. The brine was pumped uphill from the central pumping station to the storage reservoir [holding 180 000 litres]. The foundations of the reservoir and remnants of the pipeline trench can still be seen.

3. The brine flowed downhill to the reservoirs at the factory [open concrete structures].

4. From the storage reservoirs, the brine was pumped to a three-stage evaporating machine where some of the moisture was removed.

5. The brine from the evaporator was then cooled to air temperature in a cooling tower, and after that, pre-cooled to 15°C.

6. The pre-cooled brine was then brought to large rectangular refrigeration tanks. These concrete tanks with the capacity of 27 000 litres, were insulated with cork. Horizontal pipes filled with ammonia cooled the brine. The brine was cooled to -10°C which resulted in a sodium chloride liquid residue in the pipes that had to be removed with mechanical scrapers.

7. The scraped-off decahydrated sodium carbonate and salt liquid was drained from the refrigeration tank on a 30 minute cycle, where it was pumped to centrifugal separators. The washing soda was separated from the rest of the liquid and the remaining liquid was pumped to another part of the factory where it was turned into salt.
8. The washing soda crystals were bleached with chloride.
9. The bleached washing soda was melted in its own water in a steam heated remelting machine.
10. The melted mixture was pumped into a large vacuum pan where it was boiled under reduced pressure until the decahydrate lost 90% of its water.
11. The mixture was pumped to another centrifugal separator, where steam was used to wash out as much of the remaining salt as possible.
12. The monohydrated sodium carbonate was then transported with an elevator into a gas-fillled Merton furnace, where it was dried into a white powder, containing 97-98% soda-ash and 1,2% salt.

Salt making process

1. After the separation of the washing soda from the liquid, the remaining ice cold liquid flowed to a large number of shallow cement ponds next to the factory where the liquid was warmed to air temperature.
2. From here the liquid was pumped to a salt factory, where it was filtered to remove dirt and other impurities.
3. The filtered liquid ran into a three-stage evaporating machine. Steam from the soda factory was used to evaporate the water to crystallise salt.
4. The moist salt went to a centrifuge to remove more of the water.
5. The salt was packed into bags and stored in a drying-shed, where the remaining moisture gradually evaporated, leaving behind a coarse powder consisting of 99% salt and 1% Soda-ash. This salt was pure enough to be used for the salting of butter and the curing of meat, but not pure enough for table salt.
6. The remaining liquid was pumped back into the crater through Mauss's cutting.


M35
Soutpan community
1
2
1
8
7
6
5
4
3
1 Community link
2 Entrance
3 Educational/accomodation
4 Research/accomodation
5 Staff facilities
6 Public
7 Semi-public
8 Open interpretation
Pedestrian routes
Protected wetland + Zoutpanspruit
Controlled vehicle access route
Main vehicle route
Game fence
SOSHANGUVE
N

ARTICLE	BURRA CHARTER	BURRA CHARTER SUGGESTIONS	CURRENT SITUATION	PROPOSAL
2	Conservation and managemer	All significant places should be conserved as an integral part of the good management of the place	Poor management results in limited available funding	To provide a physical structure allowing management and research to continue as an active part of the site.
3	Cautious approach	Change as much as necessary but as little as possible	The factory is deteriorating over time as it is left to decay. The site is dangerous to any potential visitors as the structures are in an unstable condition.	To retain as much as possible of the existing structures and to make them accessible to the general public in a controlled way.
4	Knowledge, skills and techniq	Bring together the necessary skills and knowledge	Nothing has been done around the factory ruins and it is suspected to be partially due to the lack of proper skills and knowledge due to limited finacial funds.	The appropriate knowledge and skills related to working with unstable structures should be employed. The proposed project focusses on the architectural element involved in the poptential development.
5	Values	Consider all values related to the site	Various communities are still involved with the site, mainly related to the sacred nature of the site. Research is also conducted.	Various discussions with staff and other memebers of the community illustarted that the site has a significant influence on the community, the framework proposes to include spaecial access for the communitv.
6	Process	The significance of the site should guide decision making. Determine the significance by investigating, make a decision and take action	The factory is significant as a physical representation of a memory passed.	The proposal investigates the role of memory and how memory can be continued as a live element of the site while protecting the existing as far as possible.
7	Use	Options to retain significant uses need to be re-investigated. A new use should involve minimal change to the place	The structures are part of the existing hiking trail	The proposed intervention includes the existing structures as part of the route through which the visitor experiences the site as a whole. Research is alos includecin the new use, and room for management has been allowed.
8	Setting	The setting contributes to the significance of the place	Only a few of the structures are visible from the hiking trail and large parts of the factory consists of underground storage tanks	The design proposal respects the submerged nature of the factory and it is consequently impolemented as a design guideline.
9	Location	The location of structures is integral to their history and significance.		

10	Contents	Contents, fixtures and objects that contribute to the significance should be retained at the place	The physical evidence of the factory's existence is slowly becoming part of the surrounding landscape, rendering it more difficult as time passes to determine what is where and why.	The proposal includes as much of the existing structure as possible, enabling visitors to view the ruins in a stable environment. The structures are generally left to decay in a controlled environment. This decision was made to allow the memory of the structure to continue in a natural way.
11	Related places and objects	Objects not at the place may contribute to the significance. Other places may also contribute to the significance	The Vredefort Dome is the other impact crater site. The visitor centre was visited earlier this year and was unfortunately experienced as disappointing. The Natural Cultural Historic museum and the Transvaal Museum currently only have one printed document related to the site, *Tswaing Meteorite Crater:An Introduction to the Natural and Cultural History of the Tswaing Region Including a Description of the Hiking Trail* .	The propsal aims to provide a comprehensive understanding of the site and in this way compensate for the general lack of available information.
12	Participation	Many people may have interests or special associations with a place. All should be given the opportunity to participate in the conservation of a place	The Soutpan community and members of the Soshanguve settlement are currently employed at TMC and various other spiritualcommunity members vsist the site on a regular basis.	
13	Co-existence of cultural values	A place may be valued by more than one community. A place should be managed to conserve all values		
14	Conservation processes	Processes used should be those that best retain the significance of the place	No obvious conservation pricesses is currently employed concerning the factory ruins.	The proposal integrates the existing structures and enables exhibitions covering the various aspects related to the site's hsitory and significance.
15	Change	Identify the reason for change. Options that retain the fabric or other characteristics that contribute to the significance are preferred	The structures are unstable and deteriorating.	The design proposal makes use of reinforced concrete as construiction material, retaining the material memory, yet applying a contemporary, clearly distinguishable finish.

16	Maintenance	Regular maintenance is good practice	With the exception of part of the hiking trail, the structures are ignored as part of the site at the moment.	The propsed facilities will accommodate administartion facilities as well as research facilities, allowing continuos management to be activated.
17	Preservation	Preservation maintains the fabric in its existing state and retards deterioration, protecting the fabric that should not be altered. Where insufficient investigation has been carried out to allow decisions to be made, preservation is the preferred conservation option	The structures are weathering due to natural determinants.	The proposal protects certain elements from extreme weather conditions, yet a decision was made to let nature take its course, and in that way allow the memory to continue without creating a false representation of the existing conditions.
19	Restoration	Returning to an earlier state without introducing new material		
20	Reconstruction	New work that is returning to an earlier state with the introduction of new material. The work should be identifiable as new		
21	Adaptation	Ask why change is needed. Explore alternative solutions for effectiveness and impact on significance. Adaptation should provide benefits by maintaining or interpreting significance.	The memory of the structures is disappearing as time passes.	The design intervention facilitates management and research facilities to accommodate the future of the site.
22	New work	New work and existing work should be clearly distinguishable. New work should be similar to existing fabric in its consideration of matters including siting, bulk, form, scale, character, colour, texture and material, but should also be contemporary		The new construction material is reinfoced concrete with a contemporary finish. The scale and proportion of the existing structures determined the scale and proportion of the new interventionby means of a grid system that was employed.
23	Conserving use	Places that are used survive. Most places have historical or social value because of their use. Continuing or reinstating a use may require changes to significant fabric. These should be minimised	The ruins are deteriorating at a faster rate due to the fact that it is generally ignored at the moment.	The motivation for the design was to ensure the survival of the strtuctures, and more importantly the memory of the site.

24	Retaining associations and meanings	Many people have special connections to a place. Often significant associations and meanings are linked to the use and fabric. Retaining relevant fabric and use may be the most effective way to retain associations and meanings.		
25	Interpretation	Interpretation integrates understanding, appreciation and enjoyment of a place and may involve signs, brochures, tours, exhibitions, events, publications, artworks and other forms of expression. It may not be confined just to the place.		
26	Applying the Burra Charter	The place should be studied, a statement of significance prepared, policies developed and necessary work done to conserve the cultural significance	Almost no documentation exist regarding the factory, with the exception of one photograph and a diagramatic plan indicating the pipelines from the crater floor.	The site was documented as far as possible by means of surveys, photographs and research [including interviews with related parties]
27	Change	Changes to a heritage place should not damage the cultural significance. Record existing conditions before any changes are undertaken.		
28	Disturbance of fabric	Fabric should not be disturbed unless it is necessary for the conservation of the place.	The factory site consits of rubble to a great extent.	Only the necessary structures will be removed to faciliate and intervention. The aim is to retain as much as possible.
29	Responsibility for decisions	Identify who is responsible for decisions about a place		Management should be properly iniiated and provide appropraiet techniques and strategies concerning future decisions.
30	Direction, supervision and implementation	ompetent direction and supervision is required during all stages of the conservation of a place		
31	Documenting evidence and decisions	Conservation is ongoing. New evidence, new historical records and decisions should be recorded systematically		Research facilities such as a library, workshops, offices and storage space is provided to enable future research and continuos dicumentation thereof.
32	Records	Records associated with the conservation and history of a place should be properly cared for and available for public access where appropriate		The library and visually accessible workshops aims to provide the general public with a better understanding of the site.
33	Removed fabric	Removed fabric should be catalogued and stored at the place		Storage facilities are provided in the design proposal.
34	Resources	Conservation work needs knowledge, skills, experience, time, money and goodwill. Resources should be reviewed in conjunction with the policy and integrated into financial planning cycles.		Commercial activities suvh as a restaurant and shops have been integrated in the design to increase financial income for the site. Propper research facilities should also encourage funding from both the private sector and Government authorities.