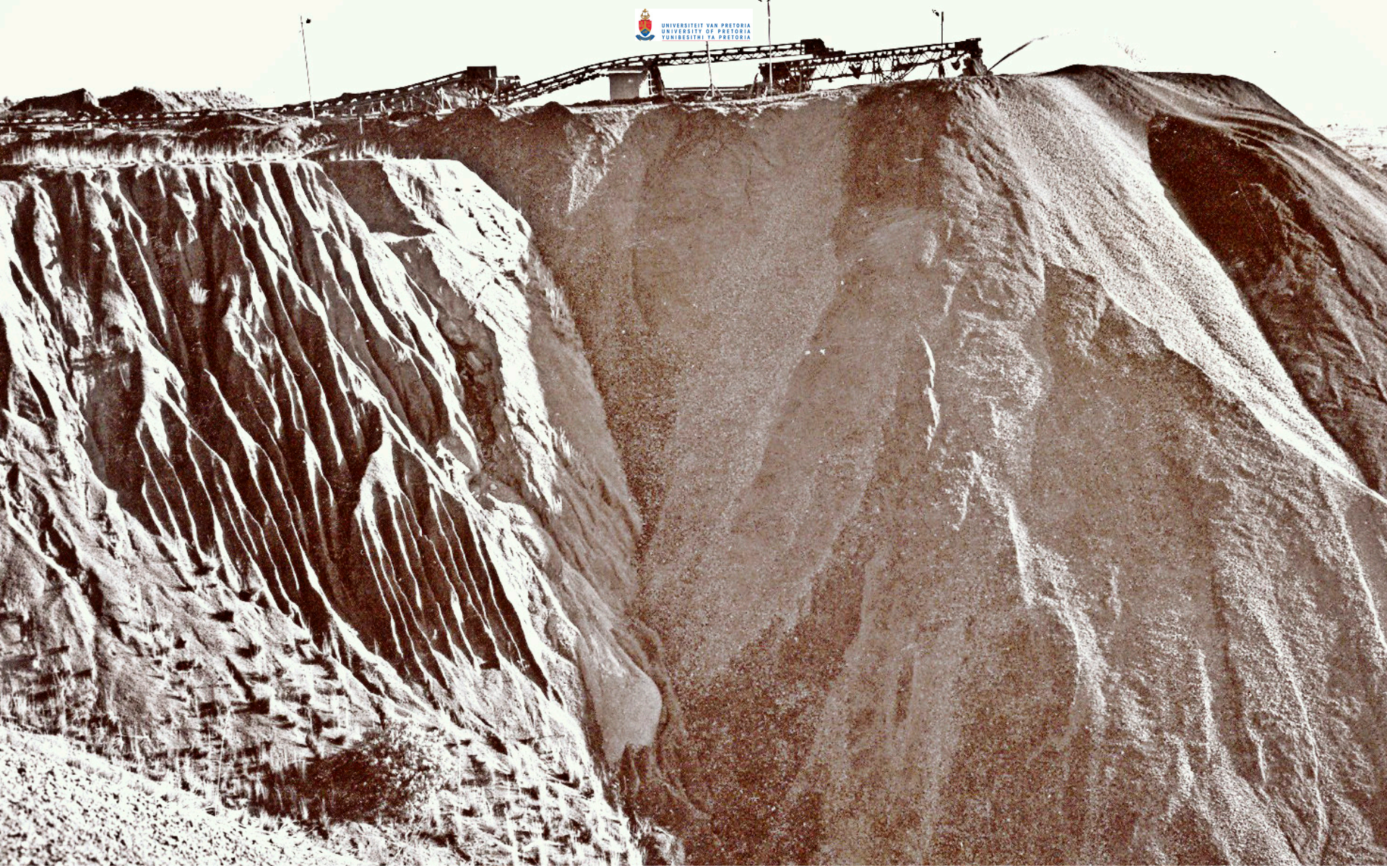
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PREFACE / Project summary, Abstract and Contents



0.1 _ (Lincoln, 2011, edited by Author)

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REDEFINING INDUSTRY/
ARCHITECTURE AS A CONSTRUCTIVE EXTRACTION

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STUDY FIELD:
Heritage and Cultural Landscapes

Submitted in fulfillment of part of the requirements for the degree
Magister in Architecture (Professional)
Department of Architecture
Faculty of Engineering, Built Environment and Information Technology
University of Pretoria

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PROJECT SUMMARY /

PROGRAMME /	Experiential industry: An essential oil extraction and cider production facility
SITE LOCATION /	Remaining Extent of Portion 3 of the farm Elandsfontein No 480 JR, Cullinan Diamond Mine, Cullinan
SITE DESCRIPTION /	The area around the No. 1 Shaft and Headgear within the Cullinan diamond mine focusing on the Crusher building and the adjacent waste rock dump site.
ADDRESS /	103 Oak Ave, Cullinan, Gauteng
GPS COORDINATES /	25°40'14.90"S ; 28°30'40.36"E; Elevation: 1476m
CLIENTS /	South African Essential Oil Business Incubator (SEOBI) South African Breweries (SAB) The Council for Scientific and Industrial Research (CSIR)
THEORETICAL APPROACH /	Resilience, Regenerative theory and Phenomenology are amalgamated with an approach to Industrial Heritage to formulate an appropriate theoretical premise that informs a new approach to industry within post-industrial scarred environment.
ARCHITECTURAL APPROACH /	Postulating an approach to industry that establishes a new relationship with the scarred environment, allows for a reflection on the past, creates an awareness of the heritage while providing a diversity of sensory and spatial experience for the formation of new memories and meaning.

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In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.
I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or other qualification.
I further declare that this thesis is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

Walter Raubenheimer

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"The industrial landscape is a misunderstood heritage: at worst, an urban rust-belt, dangerous, a toxic wilderness; at best, an outstanding historical resource to be re-used, regenerating communities, offering real richness and opportunity, reinforcing cultural identity and creating new commercial prospects" (Cossons, 2012:14).



0.2 _ Birds eye aerial view of the Cullinan diamond mine. (Lincoln: 2011, edited by Author)

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ABSTRACT /

The birth of this dissertation is founded in a personal fascination with the industrial archetype, which has developed over time from crude mechanistic structures to refined, sophisticated edifices of technological and structural ingenuity. However by excluding human experience and disregarding the making of public space, industry has isolated itself, creating limited and restricted spatial and experiential environments. Additionally, the extraction of natural resources has led to a destructive relationship between industry and the landscape creating a scarred environment. As natural resources are exhausted, widespread deindustrialization is becoming a reality where mines fail to meet demands of profitability. Man is now tasked with reclaiming his sense of place within the post-industrial scarred environment as the legacy of a mechanized industrial age.

The genesis of Cullinan is woven into the very fabric of the diamond mine as the catalytic core which extracts resources to sustain its surroundings economically. Its inevitable decommissioning and the current rehabilitation strategy proposed by mine authorities, will create an inaccessible industrial ruin devoid of meaning and quality that allow for man's sense of belonging. This threatens the tangible and intangible industrial heritage value of the mine resulting in a loss of authenticity and connection with place.

Through an exploration of the scenario following the decommissioning of the mine, this dissertation investigates the role that architectural design can play as an alternative solution to increase resilience while regenerating the scarred landscape. By utilizing the principles of regenerative design, unexpected potential was discovered and harnessed to inform the design of a facility for the extraction of essential oils and the making of cider as interconnected industries providing social and economic incentive for rehabilitation.

The concept of constructive extraction, reinsertion and reconciliation informed a new approach to the design and technification of industry. Through this approach an architecture of the senses and experience is created by a promenade in the scarred environment. A new mutualistic relationship is thus established between the landscape and production through this experiential interface The architecture becomes a multi-functional regenerative device which redefines industry, remediates the scarred environment by giving resources and nutrients back to the landscape and creates new social and economic opportunities in the industrial heritage precinct.

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ACKNOWLEDGMENTS /

This dissertation is dedicated to Yahweh, The Master Architect of whose greatest work is creation itself.

I would like to thank Prof. Arthur Barker for his enduring patience, motivation and encouragement throughout the year.

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Last but not least I would like to thank my parents for their support and kindness and Craig for his help with building the model.

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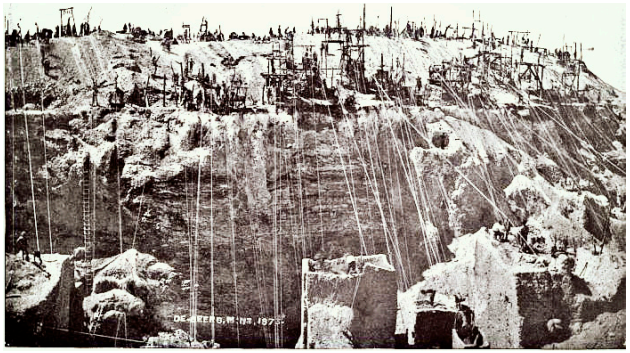
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CHAPTER 01 / THE BIRTH, LIFE AND DEATH OF AN INDUSTRIAL ARCHETYPE _

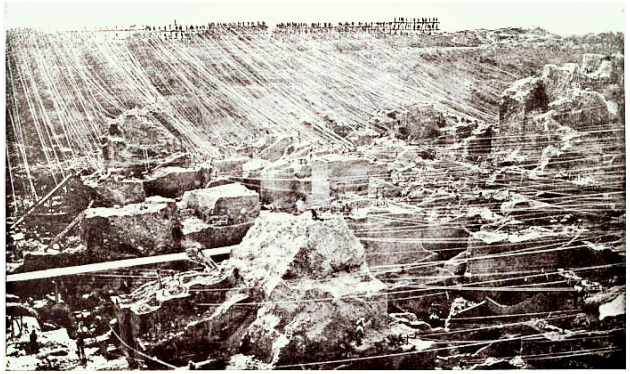
Background, Introduction and Problem Statement

1.1 _ (Lincoln: 2011, edited by Author)

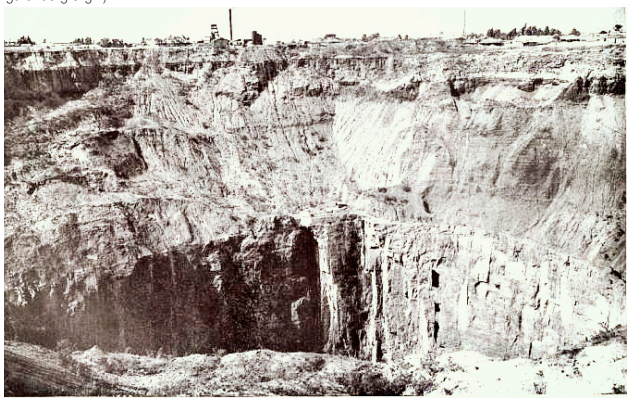
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1.2. _ Diamond mining at Kimberley in 1873 (Project Gutenburg Ebooks <http://www.gutenberg.org>)



1.3. _ Diamond mining at Kimberley in 1874. (Project Gutenburg Ebooks <http://www.gutenberg.org>)



1.4. _ Diamond mining at Kimberley in 1902. (Project Gutenburg Ebooks <http://www.gutenberg.org>)

BACKGROUND/ 001

THE ADVENT OF DIAMOND MINING AND THE INDUSTRIAL REVOLUTION IN SOUTH AFRICA:

The first diamond discovered in South Africa was the Eureka Diamond, found in 1866 on a farm near Hopetown by a young boy named Erasmus Jacobs, who was completely oblivious of its value. It weighed approximately 21.25 carats (Davenport 2013: 39). In 1869 the opening of the Suez Canal placed significant stress on the South African economy, as it became deprived of contact with a large number of trade ships traveling between Europe and the East. In 1867 the first major discovery of diamonds, 1000km north of what is today Cape Town, brought great relief to the economy during a period when it needed it most (Wilson 2010: 67). In 1869 an 83.5 carat fine white diamond was picked up by a Griqua shepherd boy called Swartbooi on the banks of the Vaal River. This caused a rush of potential prospectors to the area, most of whom were Dutch speaking farmers. Fortune seekers and adventurers from the British colonies of the Cape and Natal followed (Davenport 2013: 41). The system of rules that were set up for the diggings was known as "The Diggers' Democracy", according to which men and women of all races and colours could search for wealth. This was an anti-capitalist system that promoted the rights of diggers and prevented the monopolization of the industry by the wealthy elite. In 1870 another huge diamond, a 50 carat blue-white, was found on Jagersfontein, and some more were found on the Dutoitspan farm, where 100 diamonds were unearthed in one week. Jagersfontein was, among other finds, also the site yielding the second-largest diamond ever, the 907 carat Excelsior (Davenport 2013: 46).

A rich kimberlite pipe was discovered on the farm Vooruitzight in May 1871. This became known as the De Beers mine, named after the owner of the farm Johannes Nicolaas de Beer. By the end of May 1871 nearly 50 000 people were active at this site. Hundreds of black men of Pedi, Tsonga, Bafokeng and Sotho communities began to arrive of their own accord, lured by commodities available at diggings such as clothes, blankets, liquor and guns. They undertook the hard work of digging, sifting and hauling, and often worked 14 hours per day, for which they received between 10 and 30 shillings per week plus food rations. The area previously known as New Rush or Vooruitzight was renamed Kimberley after Lord Kimberley, British Colonial Secretary at the time. Here, diggers were rewarded with between two to six good gems each day. This rich-yielding pipe become known as the Kimberley Mine or Big Hole (Davenport 2013: 59). The dry diggings became a gigantic honeycomb where some diggers went as deep as 50 feet. This undermined the roadways and the ground of adjoining properties, and by the end of 1872 all the roadways had collapsed. These were replaced by a system of aerial tramways supported by timber staging. The capital required for this operation forced most independent diggers to abandon their operations, and the democratic nature of the diggings gave way to monopolistic capitalists. This enabled an aggressively organized and racially dominated form of industrial capitalism. It is therefore not surprising that the mining industry is closely connected with South Africa's wider history of conquest, discrimination and dispossession (Davenport 2013: 2). From 1877, steam-powered machinery became the dominant motive power in the industry, which increased the amount of kimberlitic ore that could be hauled per day from 50 loads to 300 loads (Davenport 2013: 63-67).

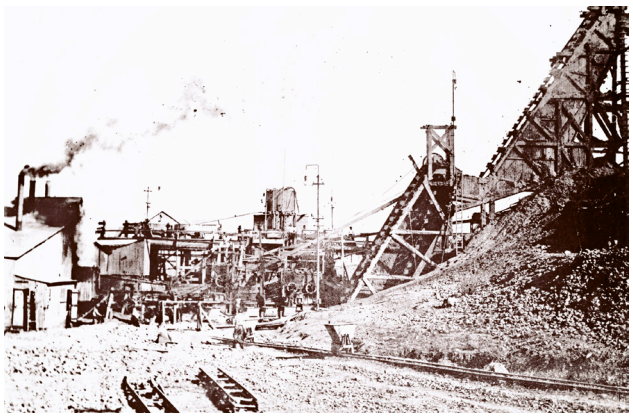
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1.5. _ Early prospecting at Cullinan in 1903. (Lincoln: 2011, edited by Author)



1.6. _ The birth of the open pit excavation at Cullinan (Lincoln: 2011, edited by Author)



1.7. _ The steam powered No.1 gear at Cullinan (Lincoln: 2011, edited by Author)

Approximately 4000 miles of railway lines had been laid by 1899 to support the rapidly expanding economy, fueled by the discovery of various rich mineral deposits. They ensured cheap and rapid transport connecting the various mining towns to the shipping lines of harbour cities (Wilson 2010: 7). The discovery of diamonds at Kimberley initiated the engine of this new economy which was later fueled by the discovery of gold in the Witwatersrand, but the establishment of a new mineral-rich industrial state did not occur without bitter conflict. In 1899 Britain's desire to control the gold-fields provoked the Zuid-Afrikaansche Republiek (ZAR) into war under President S.J.P. (Paul) Kruger. In 1902 the final peace treaty gave the former republics the white-only franchise they had striven for (Wilson 2010: 70). On the 1st of December 1902 the Premier Mining Company was registered by Thomas Cullinan, and on the 24th of April 1903 production commenced when the first steam plant, known as No. 1 Gear, was put into commission.

Economically, South Africa's industrial revolution was brought about by the discovery of rich mineral deposits, later expanding to include mechanized farming and mass-production of goods (Wilson 2010: 77). This process of industrialization was accompanied by rapid urbanization, as people were drawn to towns by new employment opportunities while at the same time being deterred from rural agrarian areas by droughts, expanded populations and the mechanization of agriculture. Approximately a quarter (25%) of the total South African population was living in urban areas by 1904; increasing to nearly a third (31%) in 1936, and by 1960 nearly half (47%) of all South Africans lived in urban areas (Wilson 2010: 73).

The fundamental flaw in this pattern of rapid economic growth was its long-term impact on the environment. Some concern was raised from time to time about the impact that soil erosion as a by-product of the mining industry would have in the long run, with the Drought Investigation Committee warning in 1922 that erosion could lead to "national suicide" (Wilson 2010: 77). However, no consciousness existed of the pollution of water sources by the mining industry. Slowly but surely the mining machine disrupted and exploited the natural environment, creating an outlandish, scarred lunar landscape through the destructive extraction of natural resources, which in time became the layered post-industrial degraded environment that we are confronted with today.

CONCLUSION:

From the above passage it becomes clear that the intensive extraction of minerals (especially gold and diamonds) played a significant role in bringing South -Africa's then backward economy into the modern, industrialized era. This enabled an aggressively organized and racially dominated form of industrial capitalism. It is therefore not surprising that the mining industry is closely connected with our wider history of conquest, discrimination, dispossession and the disruption of the natural environment (Davenport 2013: 2). In South Africa the industrial revolution had a major impact on the fundamental aspects contributing to the development of the country as a whole. These aspects include: technological development, new methods of organizing labor, new means of applying the power of water and steam to manufacture or extract, novel models of settlement, and new typologies of buildings in the form of mills, factories and mining infrastructure.

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1.8. _ Mine workers at Lonmin demanding a wage increase of R12 500 per month (Daily Maverick, <http://www.dailymaverick.co.za>).



1.9. _ Mine workers striking at the Lonmin Platinum mine in 2012 (Daily Maverick, <http://www.dailymaverick.co.za>)



1.10. _ Police brutality at Marrikana on 16 August 2012 where 34 mine-workers were killed.(Daily Maverick, <http://www.dailymaverick.co.za>)



1.11. _ Police brutality at Marrikana on 16 August 2012 where 34 mine-workers were killed.(Daily Maverick, <http://www.dailymaverick.co.za>)

THE CURRENT CONDITION OF THE MINING INDUSTRY IN SOUTH AFRICA:

According to Holmes (2014) the gross domestic product (GDP) of South Africa has shrunk for the first time since the 2009 economic recession, decreasing by 0,6% since the beginning of the year. Holmes (2014) attributes this significant fall in productivity to a substantial loss of output in the mining and quarrying industries, which have decreased their productive output by approximately 25%. Statistics South Africa (Stats SA) reports that: "Economic activity in the mining and quarrying industry reflected a negative growth of 24.7%, due to lower production in the mining of gold, platinum and diamonds (Stats SA 2014). Additionally, this sector of industry has been plagued by mass strikes in the platinum sector. Approximately 70 000 mineworkers joined the strike which was organized by the Association of Mineworkers and Construction Union (AMCU), and engaged in an all-or-nothing work stoppage based on their demand for a basic minimum wage of R12 500 per month. A loss of up to 8.4 billion rand in workers' wages has been suffered so far, while 18.6 billion rand in revenue has been lost by the platinum industry. Despite significant profit escalations in the platinum sector, nothing has trickled down to the mineworkers, who work under dangerous and often life threatening circumstances.

THE MARIKANA MASSACRE:

According to South African History Online (SAHO) (2013), the strike at the Marikana platinum mine in Rustenburg began on the 9th of August 2012 over a wage dispute between workers and management. Two police officers and two security guards were among the 10 people who lost their lives as violence intensified. Striking workers started infiltrating production areas of the mine, assaulting various employees on duty and torching six motor vehicles on the premises. On the 15th of August the possibility of a truce between the police and striking mineworkers on a hill, which functioned as their gathering point, collapsed when the mine-workers refused to disarm (SAHO 2013). On the 16th of August 2012, the police opened fire on a crowd of striking mineworkers which left 34 dead and 78 wounded, with 259 mineworkers arrested by the police. This event was the biggest incident of police brutality since the birth of democracy and prompted wide scale criticism, with some people labeling it "the ANC's Sharpeville," while others insisted it should serve as a catalyst for change. Leon (2012: 1) stated that: "Marikana is clearly an epiphany for the country as much as the mining industry. Despite its underlying tragedy, it is also an opportunity for government, labourers and business to learn from its terrible lesson and build a better, more inclusive and sustainable industry."

CONCLUSION:

From the above section it becomes clear that South Africa can no longer rely exclusively on the mining industry to drive and power its economy, as it has in the past. This industry, being reliant on the extraction of non-renewable resources, is unsustainable and its production capacity cannot be maintained. The decline of this sector of industry is therefore inevitable, and will be followed by the decommissioning of numerous industrial mining sites as it becomes increasingly complicated and uneconomical to extract resources. This de-industrialization will leave behind numerous redundant post-industrial scarred environments, which would be inaccessible to the public, damaging to the surrounding ecology, and devoid of purpose and meaning. Would this be the only legacy we leave behind for future generations of a post-industrial society? What role can architecture play in establishing a sustainable, resilient future for post-industrial scarred environments?

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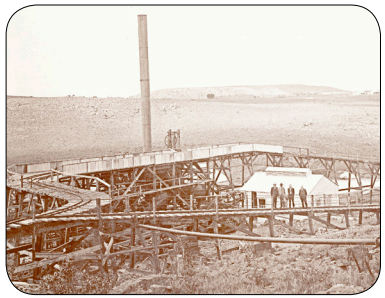
INTRODUCTION/

THE EVOLUTION OF THE INDUSTRIAL ARCHETYPE:

The following section will conduct an investigation into the development and evolution of the industrial archetype in order to determine the informants that guided the design approach and how they were derived. The relationship between form and function will be established in order to understand how the primary concerns and approach to industrial architecture has changed and evolved over time. Through an understanding of its history, development and evolution, the proponents of its inevitable demise can be identified and the role of architecture in establishing a resilient future for the post-industrial scarred environment can be recognized.

THE INCEPTION OF A MACHINE

NO. 1 AND 2 GEARS ,1903-1904, PREMIER DIAMOND MINE, CULLINAN

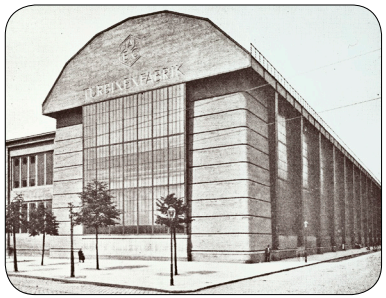


1.12. _ (Lincoln: 2011, edited by Author)

In 1903, the extraction of diamond-rich kimberlite commenced at the Cullinan Diamond Mine when the first steam plant, known as No. 1 Gear, was put into commission. The architecture of this steam plant was informed purely by the functional requirements of the extraction and production processes, being designed to achieve optimal production efficiency. In 1904 a second washing plant, known as No. 2 Gear and consisting of eight rotary pans, was brought into operation. As with No. 1 Gear, the design of this washing plant was also informed purely by function and processes (Lincoln 2011: 56).

THE CONCRETE SHED

AEG TURBINE FACTORY,1909, PETER BEHRENS, BERLIN, GERMANY



1.13. _ (Winter, 1970: 69, edited by Author)

This factory is often claimed to be the first modern building. Its immense size dominates the landscape with an expressed structure of steel and concrete. The massive concrete corners give a feel of solidity and stability to eyes accustomed to masonry construction. The meeting of architecture and industry is expressed as a steel Parthenon The client of the AEG Turbine Factory had a significant agrarian heritage. In response to this, Behrens designed the form of the building to reference the agricultural shed typology of the time, reinterpreted in steel and concrete (Winter 1970: 69).

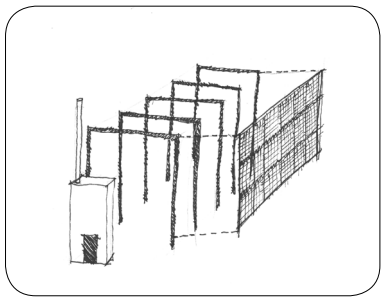
THE TRANSPARENT SKELETON

FAGUS FACTORY,1911, WALTER GROPIUS AND ADOLF MEYER, LOWER SAXONY, GERMANY



1.14. _ (Winter, 1970: 71, edited by Author)

This shoe factory designed by Walter Gropius and Adolf Meyer was the first attempt to express the lightness of a skeleton construction by using a whole wall of glass (Winter 1970: 69-71).



1.15. _ (Author, 2014).

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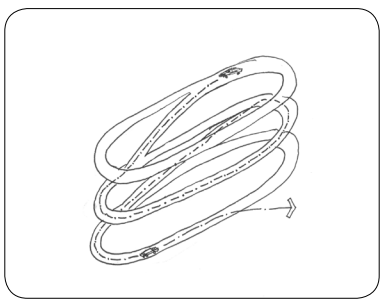
FUTURIST FANTASY

FIAT WORKS, 1927, MATTE TRUCCO, TURIN, ITALY



1.16. _ (Winter, 1970: 71, edited by Author)

Matte Trucco designed the Fiat Works in 1927 to exemplify the futurist vision of movement and speed as expressed through architecture. This was achieved by means of an assembly line that extends from floor to floor, being connected by great spiral ramps, with a car-testing track on the roof of the building. Every space within the building was therefore accessible by car. Mouldings and other architectural elements were incorporated into the design, showing a clear reference to classical architecture (Winter 1970: 71- 72).



1.17. _ (Author, 2014).

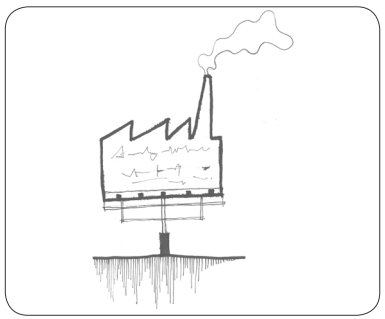
FACTORY AS BILLBOARD

HOOVER FACTORY, 1930, WALLIS GILBERT AND PARTNERS, LONDON



1.18. _ (Winter, 1970: 72, edited by Author)

During inter-war years the advertising industry saw factories as potent promotional devices. The main purpose of the composition of the Hoover Factory was to impress the public, with its core columned like a classical building and flanked by towers reminiscent of Mendelssohn's Einstein Memorial, and the factory itself being a four-story concrete structure with triangular bay windows. The building was situated in a prominent position, facing onto a busy highway so as to function more effectively as an advertisement for the products made within (Winter 1970: 85).



1.19. _ (Author, 2014).

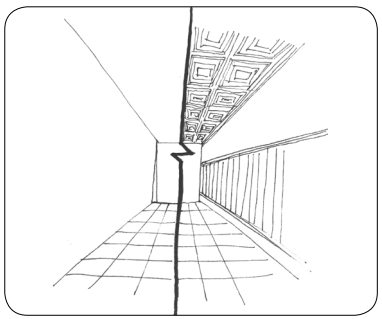
PURIST VISIONS

VAN NELLE TOBACCO FACTORY, 1930, BRINKMAN, ROTTERDAM, NETHERLANDS



1.20. _ (Winter, 1970: 73, edited by Author)

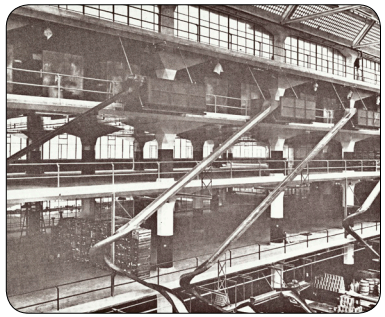
The Van Nelle Tobacco Factory embodies the culmination of the multi-story framed factory typology and is a prime example of Dutch constructivism. The owner's brief stated that "no kind of decoration should be used anywhere, as it is held to have an adverse effect upon the workers." In response to this the typology was designed in a minimalist and functional manner, omitting any aesthetic decorative elements (Winter 1970: 73).



1.21. _ (Author, 2014).

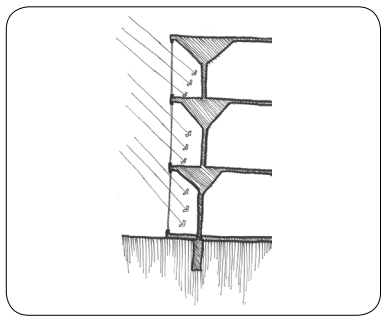
FREEING THE FACADE

BOOTS FACTORY, 1930, SIR OWEN WILLIAMS, BEESTON, NOTTINGHAM



1.22. _ (Winter, 1970: 73, edited by Author)

The design of this factory employed a revolutionary architectural approach for its time by utilizing mushroom columns as a cantilever construction system, allowing the structure to be completely set back from the facade. The facade now being structurally free was expressed as a vast glazed skin. This allowed natural daylight into the building by opening it up through a series of glazed wells (Winter 1970: 73-74).

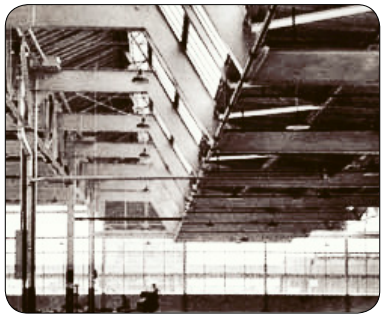


1.23. _ (Author, 2014).

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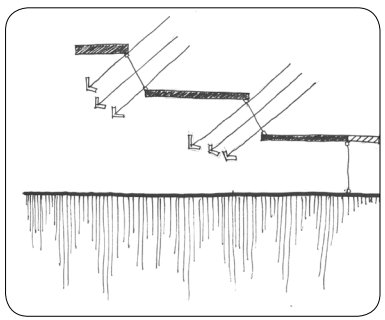
THE ROOF AS MEDIATOR

CHRYSLER HALF-TON TRUCK PLANT, 1936, ALBERT KAHN, DETROIT, USA



1.24. _ (Winter, 1970: 95, edited by Author)

Albert Kahn's industrial buildings provided flexibility to allow for inevitable changes in production while satisfying requirements of economy, cost and maintenance. The Chrysler Half-Ton Truck Plant uses deep long-span trusses to prevent obstruction of the floor area, roof monitors for natural daylighting and glass curtain walls to allow for a connection with the exterior. The roof structure had alternate areas that were raised and lowered permitting glazed areas between them to bring in light from above. (Winter 1970: 95).



1.25. _ (Author, 2014).

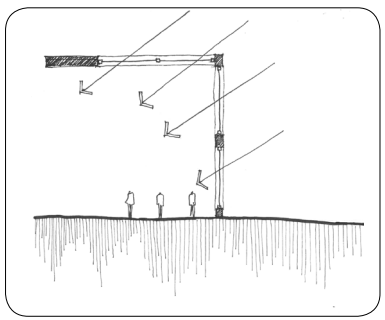
THE FUNCTIONAL CATHEDRAL

OPTICAL SHOP FOR THE US NAVY, 1941, ERNEST KUMP, SAN FRANCISCO, USA



1.26. _ (Winter, 1970: 95, edited by Author)

The walls and roof of this building are entirely made up of glazing to allow internal spaces to be flooded with natural daylight. These interior spaces acquire a cathedral-like scale (Winter 1970: 95).



1.27. _ (Author, 2014).

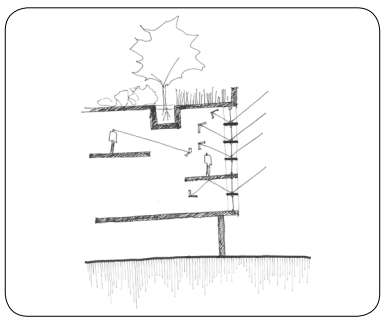
RE-IMAGINING FUNCTION

DUVAL FACTORY, 1945, LE CORBUSIER, ST. DIE, VOSGES, FRANCE



1.28. _ (Winter, 1970: 79, edited by Author)

The Duval Factory was the only industrial building designed by Le Corbusier. It addressed the functional requirements imaginatively, drew filtered light into the building through brise-soleil, and made use of an elegant concrete frame support structure. Its ceilings were painted in bright patterns and it had a roof garden. Inside, some of the workers were placed on a gallery to make the production spaces more aesthetically pleasing (Winter 1970: 79-80).



1.29. _ (Author, 2014).

PURE FUNCTIONALISM

WASHING PLANT, 1948, PREMIER DIAMOND MINE, CULLINAN



1.30 _ (Author, 2014)

In 1948 the new main processing and washing plant was constructed at the Cullinan mine to process kimberlite ore from the underground mining operations. The industrial typology at the mine consists primarily of lightweight steel portal frame structures covered with metal sheeting, with masonry walls in certain areas on the ground floor as required by the production processes. The roof structures step up towards the ridge to allow for a clerestory strip window which brings in natural daylight and allows for some degree of ventilation. These buildings exhibit a straightforward functionalist approach to industrial architecture, being designed by engineers to allow for the optimal efficiency of production processes. The architecture is informed purely by its functional requirements, with no reference to or relationship with human scale or experience (Lincoln 2011: 56).

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A SCULPTURAL TECTONIC LANDMARK

NO. 1 SHAFT AND HEADGEAR, 1945, PREMIER DIAMOND MINE, CULLINAN



1.31. _ (Author, 2014)

According to McGill (2014) the No. 1 Headgear that was erected in 1945 came from a decommissioned Anglo American shaft on the East Rand. This statement is well founded when considering the scarcity of steel and other construction materials during this post-war period. Furthermore, the fact that the entire structure consists of a kit-of-parts riveted together with no welding connections makes it appropriate for rapid dismantling and relocation. The purpose of this headgear is to hoist chutes containing diamond-rich kimberlite ore from the underground mining tunnels. After being extracted, the ore is conveyed to the washing plant, where it is crushed and processed before being transported to the sorting facility. Even though the intricate tectonic structure of the headgear is informed purely by function it has become an impressive tectonic sculpture and landmark in the industrial environment of Cullinan.

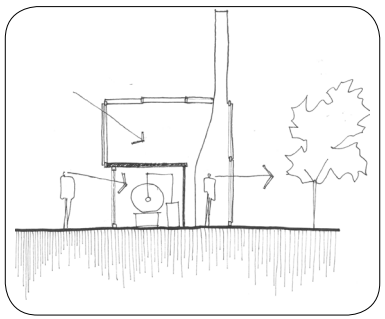
THE BEAUTIFUL BOX

BOILER HOUSE IN HALSINBORG, 1952, BLASBERG AND JAIS-NIELSEN ARCHITECTS, HALSINGBORG, SWEDEN



1.32. _ (Winter, 1970: 108, edited by Author)

This boiler house in Sweden consists of a glazed box framed in black-painted structural steel to achieve a precise industrial aesthetic derived from the work of Mies van der Rohe. This creates an elegant, geometric industrial building with a direct visual connection to the exterior environment. The architecture frames and exhibits its content, endowing the machinery with a sculptural quality and displaying the production processes as an honest representation of its internal functions (Winter 1970: 108).



1.33. _ (Author, 2014).

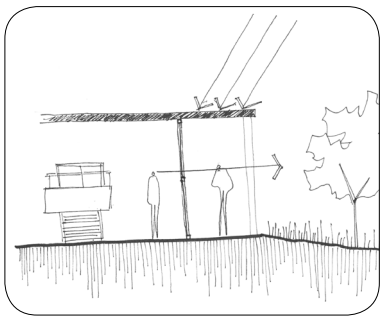
THE CLIMATIC BOX

HOME NEWS PRINTING WORKS AT FRANKLIN, 1961, SKIDMORE OWINGS AND MERRILL, INDIANA, USA



1.34. _ (Winter, 1970: 111, edited by Author)

In this printing works by Skidmore, Owings and Merrill the structural framework is taken to the outside of the factory skin to offer protection from direct sunlight and to express the frame more clearly. Climatic considerations are thus addressed without losing the spatial and visual continuity between exterior and interior (Winter 1970: 110-111).



1.35. _ (Author, 2014).

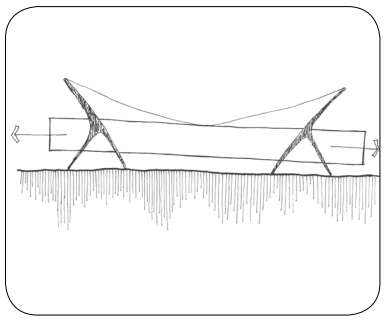
THE FLOATING BOX

BURGO PAPER MILL, 1962, PIER LUIGI NERVI, MANTUA, ITALY



1.36. _ (Winter, 1970: 83, edited by Author)

Having very specific functional requirements, the building had to house a long machine which took in logs at one end and delivered rolls of paper at the other. This machine had to be capable of extending sideways to three times its length and required a floor space of 244m long by 30m wide. In response to this Nervi produced a suspension bridge, hanging the great roof from towers that were 50m high. The towers lean outwards and have extra legs to improve stability (Winter 1970: 82-83).



1.37. _ (Author, 2014).

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HIGH TECH SUSPENSION

FLEET GUARD FACTORY, 1981, RICHARD ROGERS PARTNERSHIP, QUIMPER, FRANCE



1.38. _ (Davies, 1988: 22, edited by Author)

The exposed external structure is the most distinguishable feature of this building which is achieved by giving the tension members prominence. By utilizing a suspension structure the span of the roof, its structural depth and the overall mass of the building was significantly reduced. This allows the interior of the roof to be uninhibited by the beam depth and provides opportunities for flexible service distribution. The structure allows for new connections, necessary for the extension of the building to be made without removing existing cladding or disrupting its use. (Davies, 1988:22)



1.39. _ (Davies, 1988: 22, edited by Author)

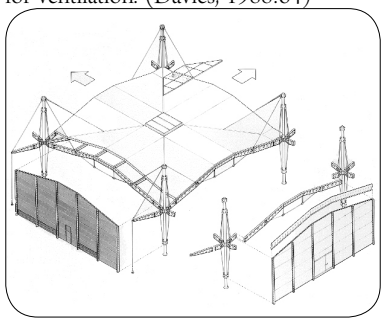
SUSPENDED MODULE

RENAULT WAREHOUSE, 1983, FOSTER ASSOCIATES, SWINDON, ENGLAND



1.40. _ (Davies, 1988: 64, edited by Author)

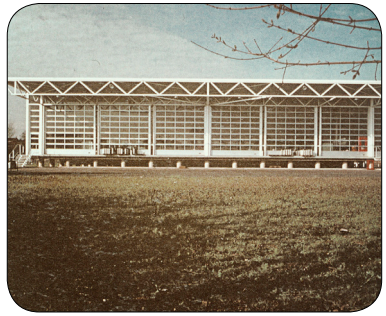
Due to the irregularity of the site, the architecture was designed as a flexible module to fill out the uneven site while allowing for spontaneous growth. From the exterior the building form is articulated by an expressive structure , consisting of arched steel beams suspended at their quarter points from circular rolled hollow steel masts, celebrated and exhibited in order to dramatize the technical function of the building elements. This structure allows for an effortless expansion without mayor disruption. A clear glass panel allows for natural daylighting while double skin UPVC louvers allow for ventilation. (Davies, 1988:64)



1.41. _ (Davies, 1988: 64, edited by Author)

OPEN TECTONICS

GREENE KING BREWERY, 1979, SUFFOLK, ENGLAND, MICHAEL HOPKINS AND PARTNERS



1.42. _ (Davies, 1988: 102, edited by Author)

The design of this brewery reflects the sequence of production and allows for a further expansion of 1670m^2. Utilizing a lightweight steel long span truss, large unobstructed open floor areas is be achieved internally, requiring no structural columns to support the span of the roof. The building stands in the floodplain of the Linnett river and therefore the floor slab is raised above the ground. The resultant expressed steel roof structure is therefore primarily a result of responding to functional requirements and material efficiency. (Davies, 1988:102)



1.43. _ (Davies, 1988: 102, edited by Author)

POROUS STEREOTOMIC SHELL

DOMINUS WINERY, 1997, SUFFOLK, ENGLAND, MICHAEL HOPKINS AND PARTNERS



1.44. _ (Betsky, 2002: 158, edited by Author)

The design approach of this building was to reinterpret the parallel lines of the vines into a built form that sits comfortably within the landscape and mimics the hills behind it. The architects used gabions filled with local stones to create a sheltering volume within the landscape. This stereotomic shell creates spaces that allow for dynamic, filtered daylight to enter and changes as the day progresses which allows for a multiplicity of experience. The offices, public and production spaces sit within glass and concrete volumes within the stereotomic shell.(Betsky, 2002:158)



1.45. _ (Betsky, 2002: 158, edited by Author)

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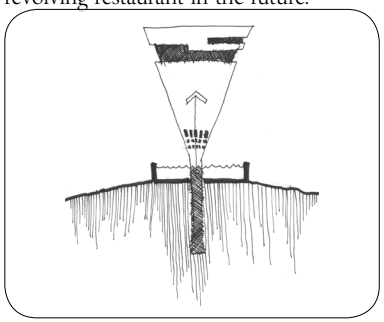
BRUTALIST MONOLITH

GRAND CENTRAL WATER TOWER, 1995, GAPP ARCHITECTS, MID-RAND, JOHANNESBURG



1.46. _ (Davies, 1988: 22, edited by Author)

This water tower was designed to provide "Half-way house", a small town to be developed in Midrand with much needed infrastructure. The objective of this structure was to transform infrastructure into an iconic landmark or beacon functioning as an orientation point, located at the end of the planned boulevard. This brutalist, sculptural structure was designed to defy gravity and give the impression of floating by touching the earth lightly at its stem, hidden below the waterline of the pond at its base. A central staircase leads to the top where provision was made for a revolving restaurant in the future.



1.47. _ (Author, 2014).

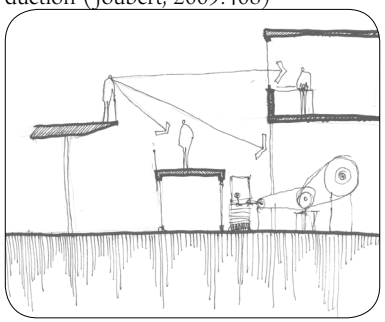
PUBLIC INDUSTRY

BARROWS, 1999, DON ALBERT AND PARTNERS, KWAZULU-NATAL, SOUTH AFRICA



1.48. _ (Joubert, 2009: 410, edited by Author)

This factory building was designed to architecturally respond in different ways to the varying scenarios of circulation around the site. The facade facing the busy Umgeni road explored the concept of billboard as metaphor, whereas the dynamic entry facade defines the threshold towards the quieter, Inter-site avenue and is conducive to contemplation. Through a sequence of meandering public circulation routes, overlooking intermediate levels of production and design, the building entices and creates curiosity in potential customers and allows for an interface between the public and production (Joubert, 2009:408)



1.49. _ (Author, 2014).

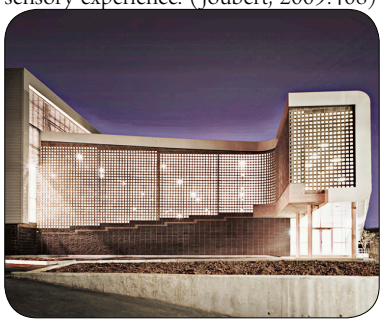
TEXTILE TECTONICS

PROUD HERITAGE CLOTHING CAMPUS, 2007, DON ALBERT AND PARTNERS, KWAZULU- NATA, SOUTH AFRICA



1.50. _ (Joubert, 2009: 414, edited by Author)

This building functions as a design, manufacturing and distribution facility for- clothes. The design and aesthetic appearance of this building was informed by the fashion industry, by metaphorically reinterpreting textiles and textures with materials such as off-shutter concrete and blockwork. The undulating entrance façade to the northern warehouse becomes an analogy for rolls of fabric while the breeze-walls of the southern-warehouse evokes veil-like associations. The internal production processes metaphorically informs the design approach to allow for a diverse spatial and sensory experience. (Joubert, 2009:408)



1.51. _ (Author, 2014).

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CONCLUSION/THE DECOMMISSIONED INDUSTRY _ DEVELOPING A NEW APPROACH TO INDUSTRIAL ARCHITECTURE

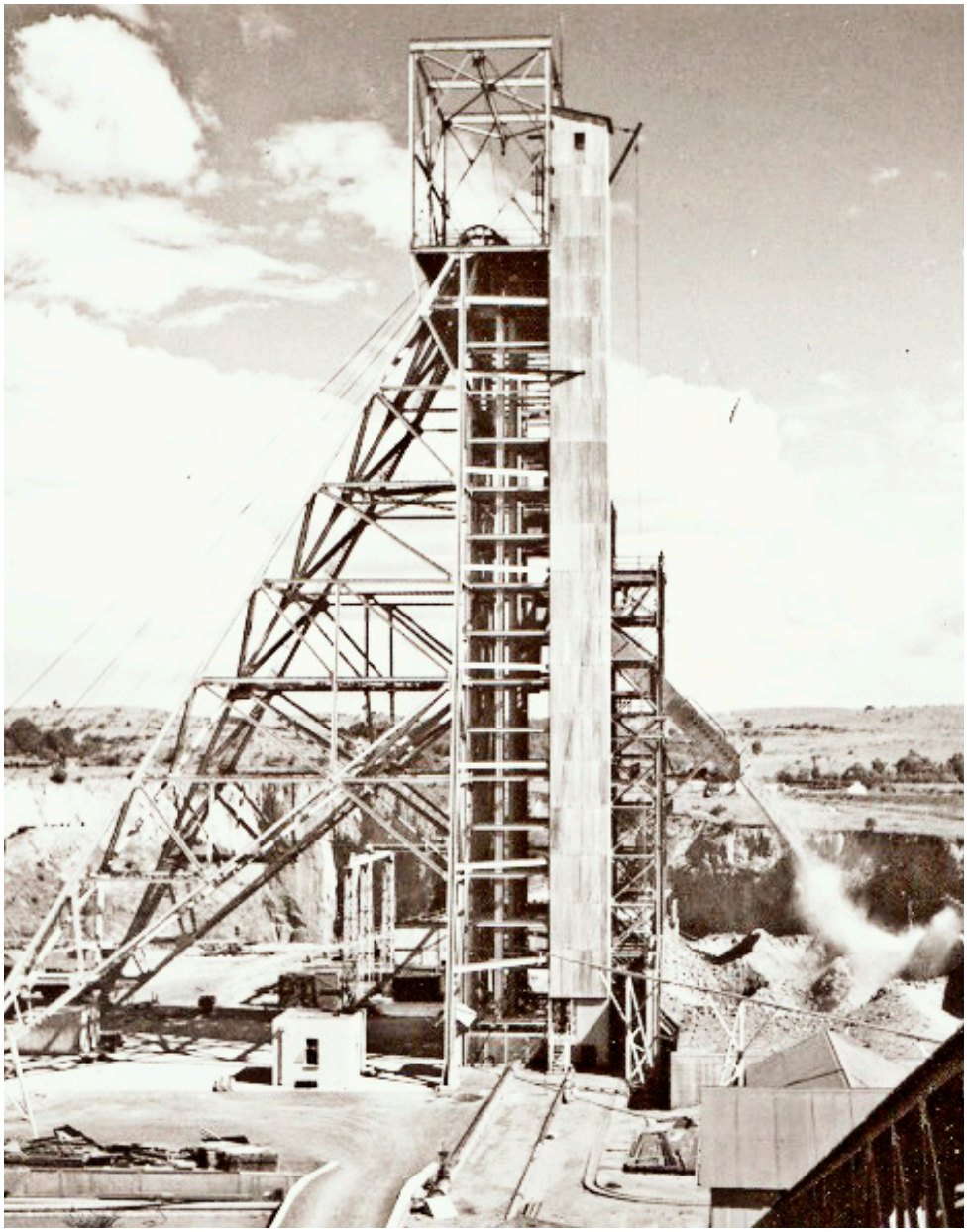
CULLINAN DIAMOND MINE, 2031, CULLINAN, SOUTH-AFRICA



1.52. _ (Author, 2014).

From the preceding investigation it becomes apparent that industrial architectural typologies have developed and evolved significantly – from crude mechanistic structures during the advent of mechanized mass-production and processing, to refined and sophisticated examples of technological and structural ingenuity. The industrial heritage at the Cullinan Diamond Mine manifests a straightforward functionalist approach to the design of industrial architecture, being primarily informed by the functional requirements of extracting diamonds as economically, efficiently and effectively as possible. This led to a typology that is predominantly concerned with the optimization of production processes and capacity. Monumental tectonic structures which control and dominate the landscape as enormous industrial machines of extraction is the architectural result. Despite the fact that this approach is undeniably the most appropriate when considering the nature of the industry, numerous concerns arise when contemplating the future of the industrial heritage after it is decommissioned. The destructive relationship between historical industry and the natural environment has created a scarred landscape with numerous ecological complications. By completely disregarding and neglecting human scale and experience in this approach to industry, a limited and restricted spatial and experiential environment has been created. The resultant post-industrial environment does not provide any opportunity or incentive for public interaction with and understanding of the industrial heritage and the scarred landscape. The decommissioned mine will become an inaccessible ruin, with the nature of its experience becoming one-dimensional and homogeneous. In light of the decommissioning of the mine the question arises as to how a new approach to industrial architecture can provide an appropriate solution to regenerate the post-industrial scarred environment while enriching its character and identity.

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1.53 _ The mine as machine exploits its environment and creates a scarred landscape (Lincoln: 2011 edited by author).

INTRODUCTION/

Diamonds are intrinsically worthless, except for the deep psychological need they fulfill – Nicky Oppenheimer (McNeil 1999).

The genesis of Cullinan is woven into the very fabric of the existing diamond mine, which acts as the catalytic core, the machine, the heart pumping lifeblood into its surroundings. To extract natural resources is a dirty process which exploits the environment. The mine's existence as a catalytic core has given birth to, and sustained, a rich character and sense of place in Cullinan, but its dependence on non-renewable resources is limited and unsustainable.

According to Dhar (2013), the Great Depression caused the American market for diamond rings to shrink significantly as sales volumes declined and the buyers that remained preferred to purchase smaller stones. At that time 75 percent of De Beers' revenue was generated through the selling of diamonds; therefore to survive they had to reverse this trend. In 1938 they turned to Madison Avenue to solve this problem, hiring the Gerold Lauck and the N.W. Ayer advertising agencies to market diamonds as a symbol of status and love in order to turn something with no intrinsic value into an extremely expensive commodity.

Current diamond mining practice in Cullinan is therefore based on fabricated value, with diamonds being given an intrinsic value through a century of manipulative advertising. In light of new technologies and diamond production methods, such as the High Pressure High Temperature (HTHP) method developed by Genesis under Carter Clarke, and the Chemical Vapor Disposition (CVD) method developed by Apollo Diamonds under Robert Linares, gem-quality synthetic diamonds that are practically indistinguishable from their natural counterparts can now be produced (Davis 1994). This questions the continued practice of unsustainable extraction of non-renewable natural resources and confirms the foreseeable decommissioning of most diamond mines.

According to Petra Diamonds, the current mining plan has an estimated lifespan of 17 years, after which the mine will be closed and all mining operations will be decommissioned (Petra Diamonds 2014).

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1.54 _ Conceptual diagram illustrating the fragmentation of the various components after the decommissioning of the mine which will result in a neglected ecology, a failing economy and a loss of cultural value (Author, 2014).

Furthermore, according to Reynecke (2011: 7) the conceptual closure plan of the mine involves the complete de-industrialisation of the mining area back to a natural state, which will occur within the next 48 years. This will result in Cullinan becoming an abandoned post-industrial town in a rural milieu.

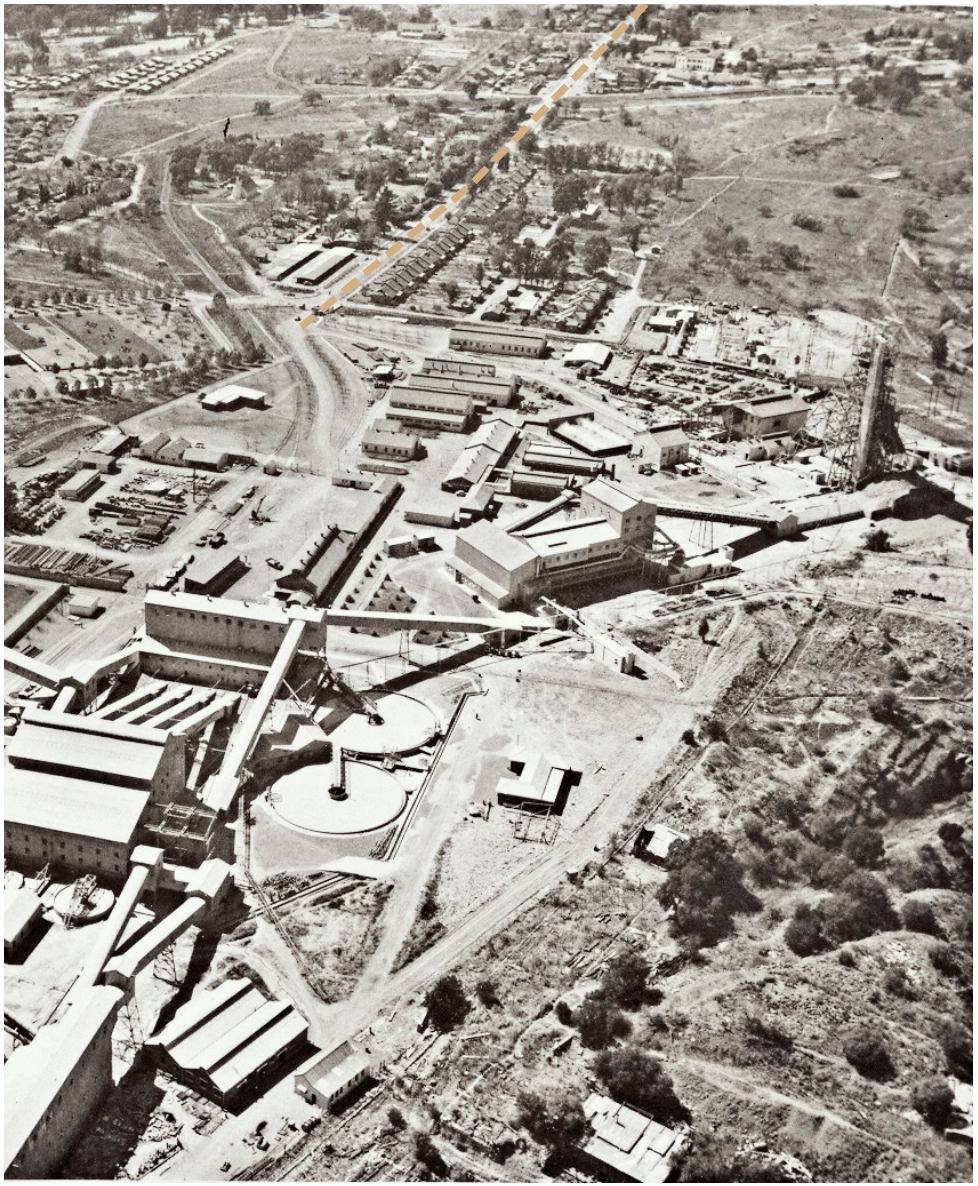
PROBLEM STATEMENT/

When the mill has closed or the seam runs out and the mine shuts down, it is the communities that survive. People are still there with their memories, their friendships and what is left of their pride (Cossons 2012: 14).

GENERAL ISSUE:

The decommissioning of the Cullinan diamond mine, and its inability to extract resources, signifies the disintegration of the catalytic core of production within the area. This will create a fragmentation of social, ecological, economic and cultural components which results in a neglected ecology, a failing economy and a loss of cultural value. The physical manifestation of industrial exploitation has created an enormous open-pit excavation, extensive kimberlite tailings and a contaminated silt dam. The closure of the mine will lead to the further degradation of the environment. According to Lincoln (2014), this will result in more than a thousand mineworkers being retrenched, which will exacerbate the existing condition of unemployment in the local community. The tangible and intangible industrial heritage of the mine is threatened by its decommissioning, which will result in a loss of its unique character and sense of place. Man is now left with the task of reclaiming his sense of place within the scarred environment, left behind as the only legacy of a mechanized age.

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1.55 _ Birds eye view showing the disconnected relationship between the mine in the foreground and the town in the background with oak avenue as the prominent linear axis around which the town developed (Lincoln: 2011 edited by author)

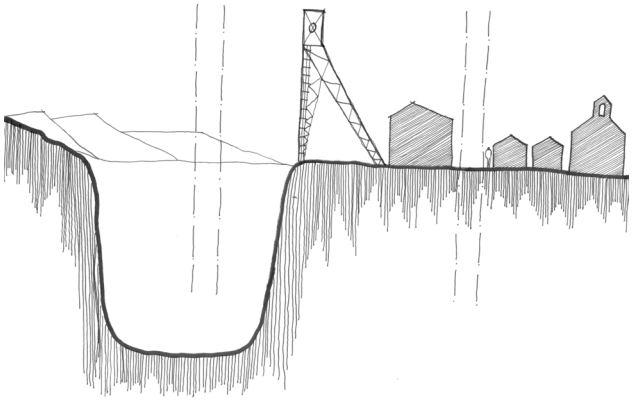
URBAN ISSUE:

Despite their state of disuse, abandoned industrial sites remain connected with the urban fabric that surrounds them: with communities; with collective memory; and with people's health, livelihoods, and stories (Mah 2012: 3).

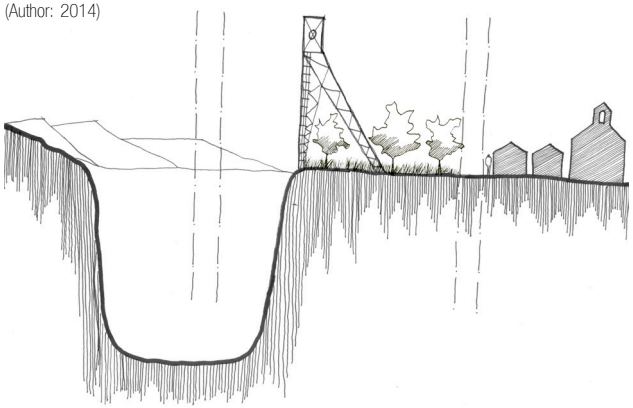
Cullinan was initially established as a colonial mining town, as a direct result of the discovery of diamonds and the potential that existed to extract these resources for revenue. Its layout is based on a strong linear axis – characteristic of the layout of English villages – which connects important buildings like the church at one end with the mine at the other. This layout establishes a contained space around the central axis with very little connection with its surrounding natural environment. Since its origin the town has developed independently from the mine in response to social conditions, and has now grown to become a regional service center (Bohlweki-SSI Environmental 2009: 12).

The mine has developed in accordance with the location of resources and the landscape has systematically been scarred in order to access these resources. It becomes clear that the original interconnected relationship that once existed between the town, the mine and the landscape has been lost. The decommissioning of the Mine will result in an even greater disconnection, isolating the industrial heritage and making it inaccessible. The proposed urban framework will address this issue by investigating how a relationship between the town, the mine and the scarred landscape can be re-established by making the threatened, decommissioned industrial heritage resilient and accessible to the public.

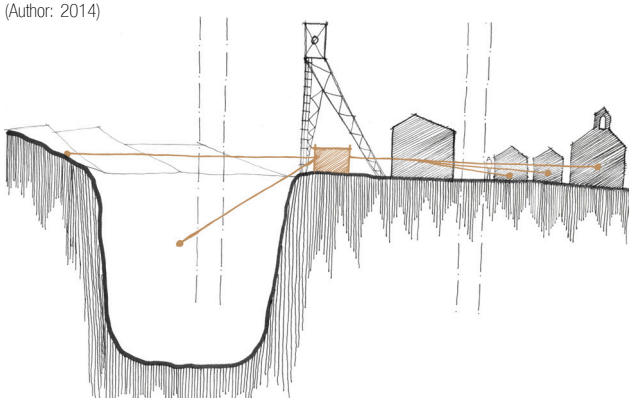
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1.56 _ The mine will become disconnected, separated and inaccessible following its closure. (Author: 2014)



1.57 _ Mine authorities proposal to return the mine back to a natural state after its closure. (Author: 2014)



1.58 _ Extracting meaning from the scarred environment to inform a new regenerative architecture. (Author: 2014)

ARCHITECTURAL ISSUE:

The industrial landscape is a misunderstood heritage: at worst, an urban rust-belt, dangerous, a toxic wilderness; at best, an outstanding historical resource to be re-used, regenerating communities, offering real richness and opportunity, reinforcing cultural identity and creating new commercial prospects (Cossons 2012: 14).

The decommissioning of the mine will create an industrial ruin – redundant, devoid of content and bare of utility, with a desolate scarred landscape as by-product of its endeavors. This decommissioning will erase the qualities that allow for man's sense of belonging, and will separate the industrial heritage from the public realm by making it inaccessible. This is shown in **Figure 1.56.**

Current rehabilitation strategies proposed by the mine authorities to mitigate the closure of the mine include the return of the majority of the mining area back to a natural state, in order for it to become part of the adjacent Premier Game Park (Shangoni 2013: 437-438). Certain historical elements, including the open pit, the headgear and the treatment facility, will be preserved as relics of diamond mining, to act as draw-cards for tourists (Shangoni 2013: 442). If the context within which these relics exist were changed from a scarred landscape to a constructed natural landscape, the relics would become uncomfortable artifacts within the wilderness, resulting in a loss of authenticity, industrial heritage value and a connection with place. This is shown in **Figure 1.57.** The value of the industrial heritage in Cullinan is not contained merely in the physical manifestation and aesthetic representation of certain buildings and structures as mnemonic devices of mining and industry. The function of these buildings, as the heart or catalytic core which produced resources in order to sustain the town and community, is what gives meaning to the heritage and contributes to its unique character and sense of place.

It is apparent that the historical approach to industrial architecture at the Cullinan mine was informed purely by function and process. This resulted in a limited and restricted spatial and sensory experience within the post-industrial environment, which completely disregards human scale and does not allow for interaction with the industrial heritage. Even though existing industrial spaces and structures do elicit a degree of sublime experience, they are often inaccessible, or the nature of the experience becomes one-dimensional and homogeneous. This has the effect of not providing the public with sufficient incentives for exploration or opportunities for understanding the scarred environment.

It is through architecture that an understanding of place can be regained. It is architecture's role to return decommissioned industrial sites to the public view, restoring their sense of place by adding a new functional and experiential layer which would reinstate meaning and initiate future development. By creating new function and meaning within the industrial heritage of the decommissioned mine, and building upon rather than removing its context, potential for future growth and renewal can be facilitated while enriching its character and sense of place. This is illustrated in **Figure 1.58.**

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1.59 _ Existing conditions within the mine (Author: 2014).

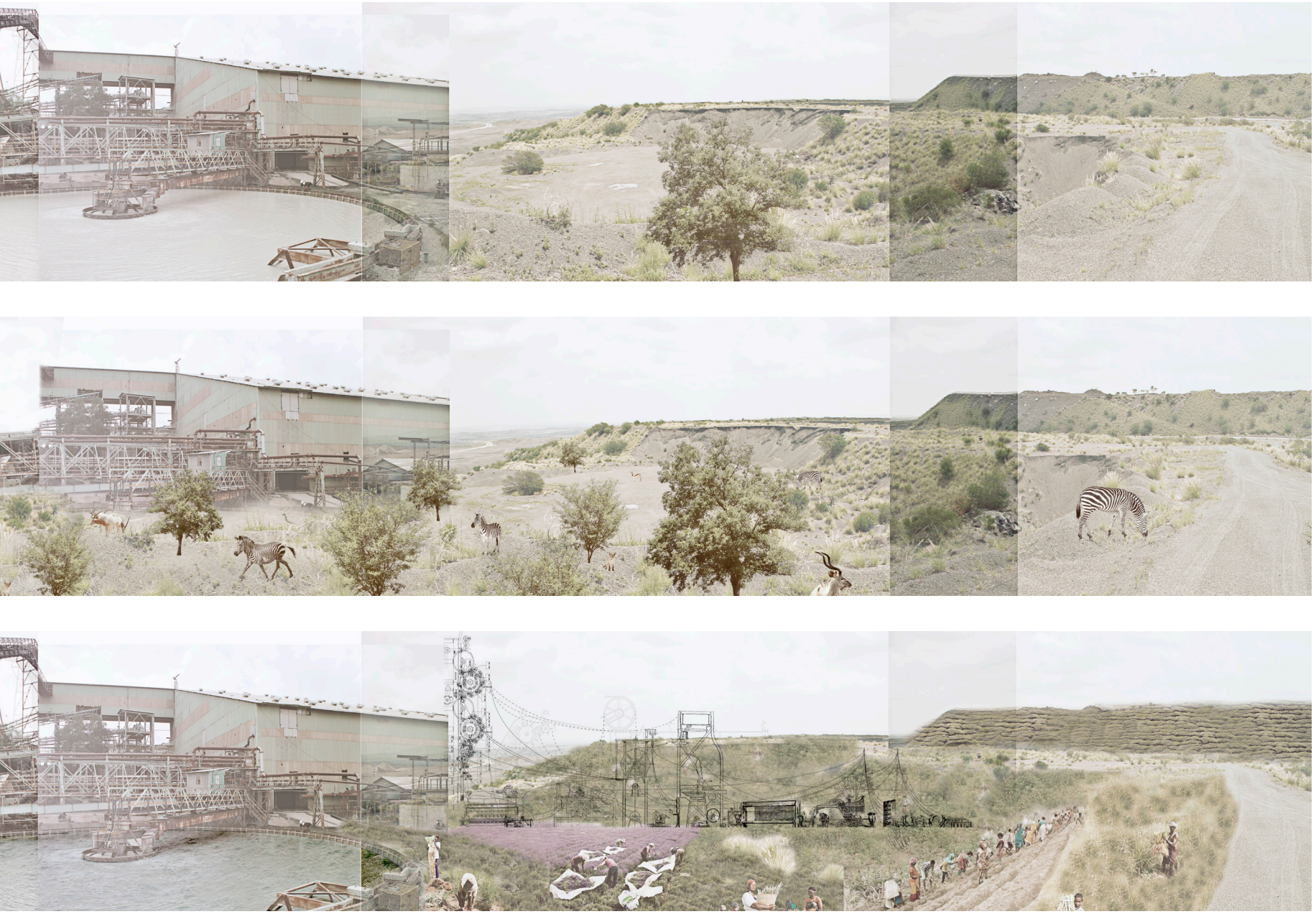


1.60 _ Rehabilitation strategy proposed by mine authorities includes returning the majority of the mining area back to a natural state, which will then become part of the adjacent Premier Game Park (Author: 2014).



1.61 _ Alternative solution to existing rehabilitation strategy proposed by author (Author: 2014).

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RESEARCH QUESTIONS/

SOCIAL AND CULTURAL

What methods can be utilized to determine and harness the inherent potential of post-industrial mining sites in order to re-integrate them into society after they have been decommissioned?
How can these decommissioned mining sites be prevented from becoming meaningless, threatening industrial ruins in a scarred landscape, with no sense of place or identity?
Industrial heritage sites are often misunderstood due to the significant social consequences that are associated with them, and the negative perceptions that prevent them from being appreciated. How can stewardship and communal responsibility for the well-being and maintenance of the industrial heritage at post-industrial mining sites be fostered?
Can architecture initiate a culture of involvement and taking ownership of post-industrial mining sites while encouraging an awareness, understanding and appreciation of the industrial heritage?

ECOLOGICAL

How can architecture play a role in facilitating the regeneration and remediation of the scarred landscape and contribute to increasing the resilience of the industrial heritage? How can regenerative design principles be applied to the practice of regenerating post-industrial scarred environments for the mutual benefit of the ecology, society and the cultural identity of the industrial heritage?

ECONOMIC

In our current capitalist society consumers are disconnected from where goods are produced due to their dependence on centralised industries. To what extent can decentralised micro-industries, which produce place-bound products, be integrated with one another, the industrial heritage and the surrounding community to simultaneously provide a new source of revenue after the decommissioning of the mine, while also regenerating the scarred environment? How can a new approach to industrial architecture reconcile consumers with the production of goods by establishing an experiential interface between the public and industry?

DISSERTATION QUESTIONS/

- What role can architecture play in establishing a sustainable, resilient future for the industrial heritage at the Cullinan Diamond Mine?
- How can the proposed development re-establish the catalytic core of the decommissioned mine which sustained and developed the town and provided a source of revenue to the local community?
- How can architecture establish a new relationship with the post-industrial scarred environment?
- How can architecture facilitate the transformation of a threatening, unapproachable industrial heritage site into an accessible and intriguing place that encourages exploration and heightens experience?
- How can architecture establish a new interface between the public realm and productive industry?
- How can architecture create a physical interaction with spaces within the industrial heritage structures that would allow for a diversity of sensory and spatial experiences and be conducive to the formation of new memories and meaning?

INTENTION OF THE DISSERTATION/

The intention of this dissertation is to question the current rehabilitation strategy developed by authorities at the Cullinan Diamond Mine by proposing an alternative solution that is resilient and initiates the regeneration of the scarred environment. Through architecture, a sense of place will be regained at the Cullinan mine, by allowing for a diversity of sensory and spatial experiences within the post-industrial scarred environment. An alternative approach to industrial architecture will be developed by establishing a new interface between the public, the productive industry and the industrial heritage.

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RESEARCH METHODOLOGY/

The following section will outline the research methodologies utilized in this dissertation to address the dissertation question and develop an appropriate architectural response.

PARTICIPANT OBSERVATION METHOD:

This method allows for a subjective understanding and at the same time a more realistic and objective view of the object of study. It depicts the urban environment not only in a descriptive and analytic way but also as being experienced and witnessed which allows for the interpretation of the urban and human condition (Breed, I. 2008:215). The aim of this utilizing this method was to capture and record information in an objective manner through observation, participation and experience in order to identify information that is relevant to the study. Through the analysis of relevant literature, secondary data, environmental reports and existing development frameworks a thorough investigation of the Cullinan area was conducted and a greater framework vision was developed within the Cullinan Framework Group. The specific area of focus (within the Cullinan mine) was observed and documented through numerous site visits and on-site interviews. A personal guided tour through the mine allowed for a crucial understanding of its history, production processes and development. This also allowed for a qualitative photographic study to be conducted of the mining area, consisting of the industrial heritage buildings and structures, the open-pit excavation, the kimberlite tailings and the waste-rock dumps, as the primary medium to capture qualitative data concerning the current site conditions.

MAPPING:

Mapping and observation within the framework area and the site informed the development of a master-plan, precinct framework and design approach. This method was used to map the position and value of the historical fabric, the existing infrastructure, the location and nature of cultural and social components, ecological and physical conditions, the landform, relationships on the site, circulation and movement patterns, existing vegetation and climatic conditions. Data from the mine;s records were also collected.

ARCHIVE:

Historical areal and site photographs, maps, literature and articles were studied to achieve an understanding of the site's past and how it developed over time. Data from the mine's records were also collected.

PRECEDENT AND CASE STUDIES:

An understanding of the program and the various productive processes was attained through interdisciplinary research, by consulting the relevant literature and by conducting a case study on local essential oil extraction facilities and a cider-making facility as a programmatic precedent. By conducting an architectural precedent study it was investigated how spatial and sensory experience can inform the making of industrial architecture on a physical and practical level.

DESCRIPTIVE INTERPRETATION:

Evaluative research and an assessment of proposed rehabilitation strategies and development framework was conducted to determine whether these strategies are appropriate and where additional solutions and improvements can be considered. By reviewing and investigating applicable critical theory and theoretical literature and publications, a theoretical departure for the dissertation was developed. By investigating pertinent theory concerning resilience, regenerative design and phenomenology, a theoretical approach was established which informed the development of the urban framework and the proposed architecture. The Nizhny Tagil Charter for the Industrial Heritage (NTCIH) and The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 1999 was consulted to inform an appropriate architectural response to the industrial heritage and the existing conditions on the site.

APPLIED RESEARCH:

The descriptive interpretation of the research culminated into a conceptual design approach, which addressed the intentions and gave expression to an architectural built-form. This conceptual approach was developed and expanded into a tectonic concept which informed every aspect of the technical resolution and detailing.

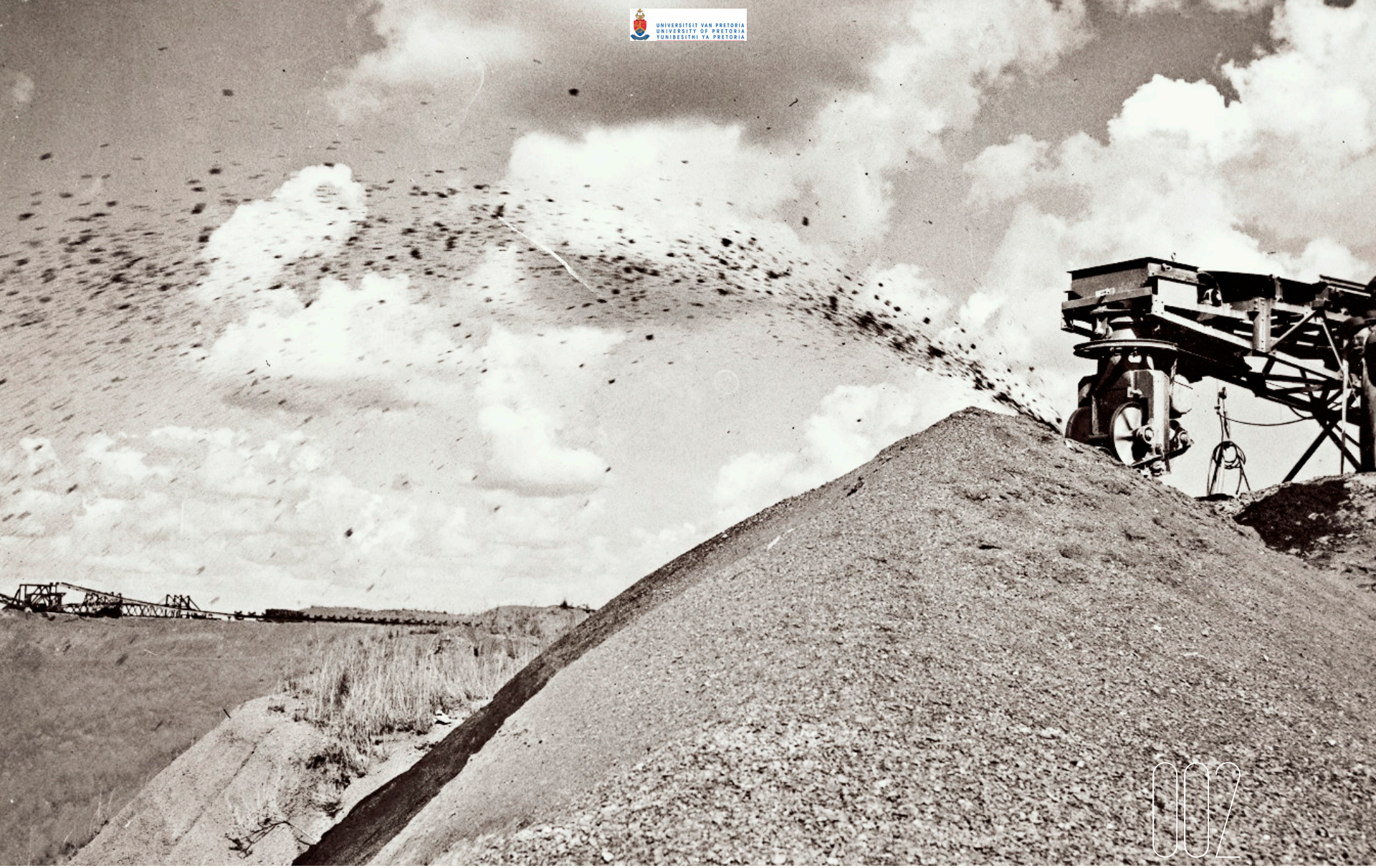
DELIMITATIONS OF STUDY/

Despite the fact that the mine is currently still in operation, the assumption will be made that, within the context of this dissertation, the mine and all relevant mining buildings and structures have been decommissioned and are no longer in use. The dissertation does not strive to develop a general model or methodology for the rehabilitation of mines in the South African context, but rather proposes an additional architectural solution to existing rehabilitation strategies at the Cullinan mine. The investigations will refrain from quantifying economic figures or economic viability as an outcome. This dissertation will seek to reintroduce a public interface, production diversity, and sensory and spatial experiences within the context of the decommissioned industrial heritage of the mine. The cross-programming of industrial production and experiential public space is prioritized in conjunction with the conservation and adaptive re-use of the industrial heritage site and structures. It needs to be clarified that the author is in no way an expert on the various production processes related to the proposed industries, but rather that the purpose was to attain sufficient understanding of these processes in the limited time available for this design dissertation, to be able to inform an architectural response. Due to the nature of this dissertation being focused on architectural design, the investigated production processes were only used as a basis to demonstrate and inform the architectural design and the possibilities that it provides for public experience of space.

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02

CHAPTER 02 / UNDERSTANDING THE POST-INDUSTRIAL SCARRED ENVIRONMENT _

Context and site analysis



2.1 _ (Lincoln, 2011, edited by Author)

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CONTEXT AND SITE ANALYSIS / 002

INTRODUCTION:

The post-industrial scarred environment that will exist once the Cullinan Diamond Mine has been decommissioned forms the context of this dissertation. In this chapter the story of a diamond mine and the significant events which played a role in its origin and inevitable demise will be narrated. A thorough analysis of the context will be conducted on three primary scales of intervention, namely:

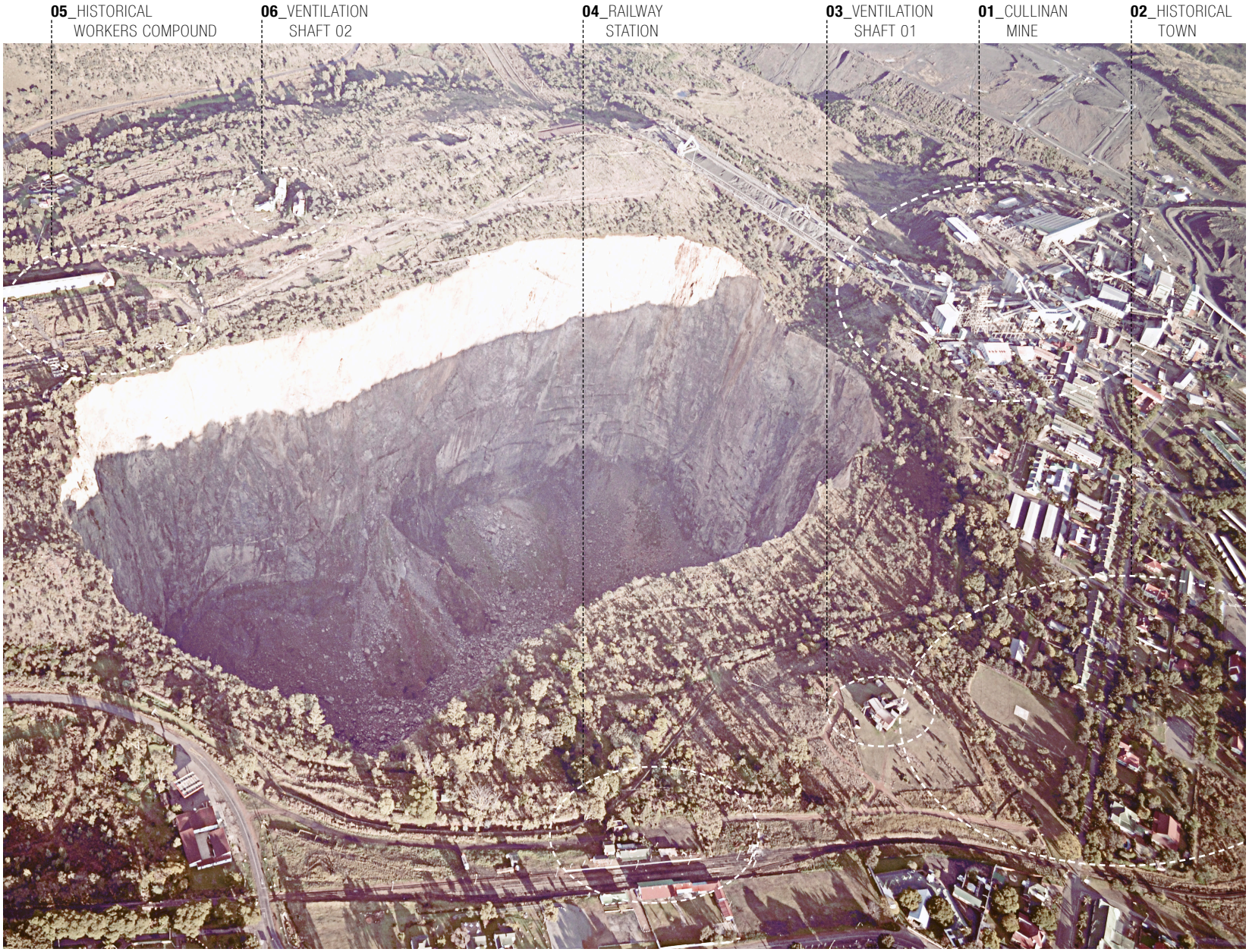
- A macro-analysis on an urban scale
- A macro-analysis on a precinct scale
- A micro-analysis on a site scale

Through this analysis the ecological condition, the heritage fabric, the climatic conditions, and the nature and topography of the land form and location of water bodies will be investigated. From this analysis conclusions will be drawn that will inform the architectural response.



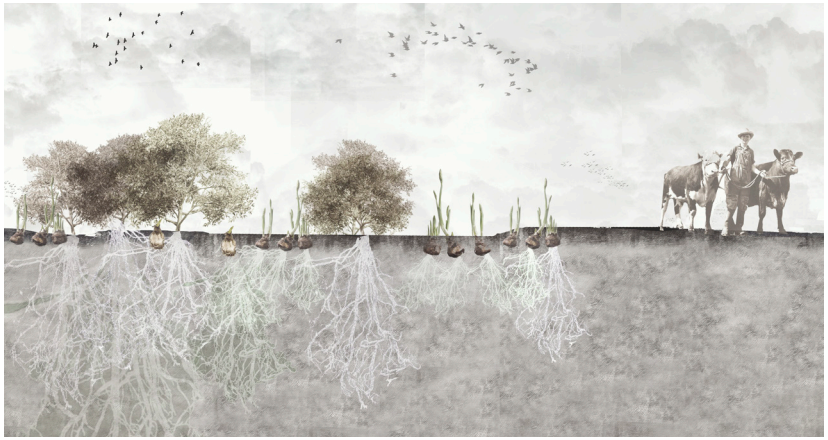
2.2 _ Tinted photograph of the Premier diamond mine at Cullinan in 1902 (Gardner: 1902, edited by Author)

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2.3 _ Birds eye view photograph of Cullinan (Mc Gill: 2014, edited by author)

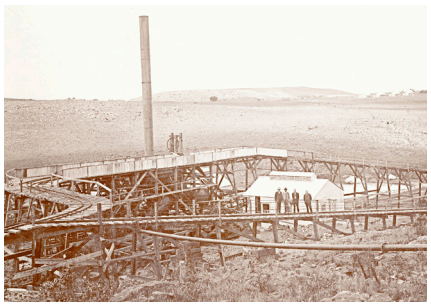
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2.4 _ Agricultural heritage of Cullinan framework group, 2014)



2.5 _ Prospecting and discovery of first alluvial diamond on boundary of Elandsfontein farm. (Cullinan framework group, 2014)



2.6 _ No. 1 gear and steam plant commissioned in 1903 (Lincoln: 2011)



2.7 _ No. 2 gear washing plant commissioned in 1903 (Lincoln: 2011)

NARRATIVE OF A DIAMOND MINE:

The following section serves to narrate the development of the Cullinan Diamond Mine over time, with visual representations of significant events which had a substantial impact on its development shown in **Figures 2.4 to 2.15.**

In 1859 the Elandsfontein farm was surveyed and set out by Cornelius Jacobus Minnaar according to the two hour horseback method. A center point and starting point would be demarcated, after which one would travel on horseback for an hour in an East-West direction and for another hour in a North-South direction to establish the extents of the farm (Lincoln 2011: 5).

During 1861 a portion of the farm was sold to Cornelius's brother Roelof Johannes Minnaar, who constructed a large farmstead and the Minaars Dam, excavated water irrigation furrows, and established vast orchards and vegetable and herb gardens (Lincoln 2011: 5). In 1896 the northern portion of the Elandsfontein farm was sold to Willem Petrus Prinsloo; the Willem Prinsloo Agricultural Museum is named after him.

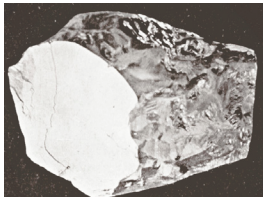
Therefore, the area today known as Cullinan has a significant agricultural heritage, as depicted in **Figure 2.4** (Lincoln 2011: 5).

Thomas Mayor Cullinan was prospecting up against the boundary of Elandsfontein farm in 1898 when he met a certain Percival White Tracey, who showed him a three carat blue-white alluvial diamond (see **Figure 2.5**).

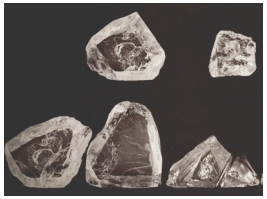
The Anglo-Boer War was conducted from 1899 to 1902. The Minnaar and Prinsloo families had to flee before the British Army, their homesteads at Elandsfontein farm were burnt, and they lost everything they owned. In 1902, after the war ended, the Prinsloo and Minnaar families returned to their farms but struggled to rebuild due to a lack of resources. Thomas Cullinan convinced the Minaar family to sell their portion of the farm to him in 1903. In that same year, the Prinsloo family also agreed to sell their portion of the farm to him.

On the 1st of December 1902 the Premier Mining Company was registered by Thomas Cullinan and on the 24th of April 1903 production commenced, when the first steam plant, known as No. 1 Gear, was put into commission (see Figure 2.6). In January 1904 a second washing plant, known as No. 2 Gear and consisting of eight rotary pans, was brought into operation (see **Figure 2.7**). Therefore it becomes apparent that there are several buildings at the Cullinan mine which have significant industrial heritage value (Lincoln 2011: 56).

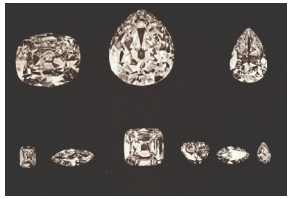
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2.8 _ The Cullinan diamond. (Lincoln: 2011)



2.9 _ The major stones. (Lincoln: 2011)



2.10 _ the nine major stones cut. (Lincoln: 2011)



2.11 _ Discovery of the largest diamond in the world at Cullinan in 1905 by Fred Wells, which eventually became part of the British crown jewels.



2.12 _ The open pit mine closed down for the first time in 1914, now being 100m deep, due to hostilities in Europe which led to the First World War. (Cullinan Group, 2014)

On the 25th of January 1905 the world's largest diamond was found by Fred Wells, the surface manager of the mine at that time (See **Figure 1.11**) (Lincoln 2011: 12).

According to The Burra Charter (Australia ICOMOS Burra Charter 1999), the open-pit excavation therefore has significant heritage value in that it is the location where an important historical event took place.

The Cullinan diamond measuring 3106 carats (shown in **Figure 2.8**) was bought by the Transvaal government who presented it to King Edward II. It was then cut by Joseph Asscher into 9 major gems and various smaller ones, as shown in **Figures 2.9** and **2.10.** The two largest gems were retained for the British crown jewels, while the other stones were given to Asscher as his fee. King Edward bought one for his consort, Queen Alexandra. The people of South Africa bought the other six gems and presented them to Queen Mary in 1910. The largest cut diamond in the world, the Cullinan I or the Great Star of Africa, is set into the imperial sceptre. The 2nd stone, the Cullinan II or the Lesser Star of Africa, is set into the imperial state crown. Today, both are on display at the Tower of London (Lincoln 2011: 15).

In 1906 the railway line between Pretoria and Cullinan was completed to supply the mine with much needed resources (Lincoln 2011: 30).

Due to the outbreak of hostilities in Europe, the mine closed in 1914 just before the First World War. The open pit had reached a depth of 100m by that time (see **Figure 2.12**) (Lincoln 2011: 49). By 1920 De Beers had enough shares in the Premier mine to have a controlling interest, and Thomas Cullinan resigned as the chairman (Lincoln 2011: 138).

Numerous peach trees grew in the open pit of which the fruits never went bad, as fruit fly attacks were deterred by the blasting fumes. People would often climb down the excavation to pick the peaches in season; the mine, however, had to destroy the trees for fear of people getting hurt (Lincoln 2011: 112).

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2.13 _ The mine closed down a 2nd time in 1932, the 186m deep excavation filled up with water. (Cullinan Group, 2014)



2.14 _ In 1932 the South African Military constructed a large military and Prisoner of war camp. (Cullinan Group, 2014)



2.15 _ In 1950 drilling revealed a 75m deep Gabbro sill absent of kimberlite ore. Underground mining operations commenced (Cullinan Group, 2014)

1930 marked the start of the global depression (Lincoln 2011: 69).

In 1932 the mine closed for the second time due to the Great Depression. The village became a virtual ghost town. The open-pit excavation, now being 186m deep, slowly started to fill up with water, as shown in **Figure 2.13** (Lincoln 2011: 71).

The closures of the mine in 1914 and 1932 show that the extraction of diamonds as a non-renewable natural resource is an unsustainable and unreliable practice, being subject to global economic and social conditions.

By 1932 the South African forces had joined the allies in World War II. The South African Military arrived in Cullinan and, as a result of the numerous vacant houses and the abundance of open veld for practice maneuvers, stationed itself there and constructed a massive military camp (see **Figure 2.14**). An Italian prisoner of war camp was opened near Zonderwater, in close proximity to Cullinan (Lincoln 2011: 89).

In 1945 the mine was re-opened, but had to be de-watered. It took 8 months to pump out approximately 740 000 000 gallons (2 800 000 000 liters) of water (Lincoln 2011: 99).

This shows that, following the decommissioning of the mine, the open-pit excavation has significant potential to function as a large freshwater reservoir. It will be able to store and provide several surrounding communities and agricultural ventures with a fresh water supply.

In the early 1950s exploration drilling revealed that, below the 370m level, the diamond-bearing kimberlite pipe was completely cut off by a 75m deep Gabbro sill which was devoid of any kimberlite ore. It was found to be uneconomical to remove this layer of rock from the open-pit mine to reach the kimberlite pipe below, but the existence of vast reserves of high-grade ore below it justified the establishment of a new mine below the Gabbro rock sill. A deep shaft was sunk adjacent to the open-pit excavation to access these underground reserves (see **Figure 2.15**), and mining operations continued underground (Lincoln 2011: 101).

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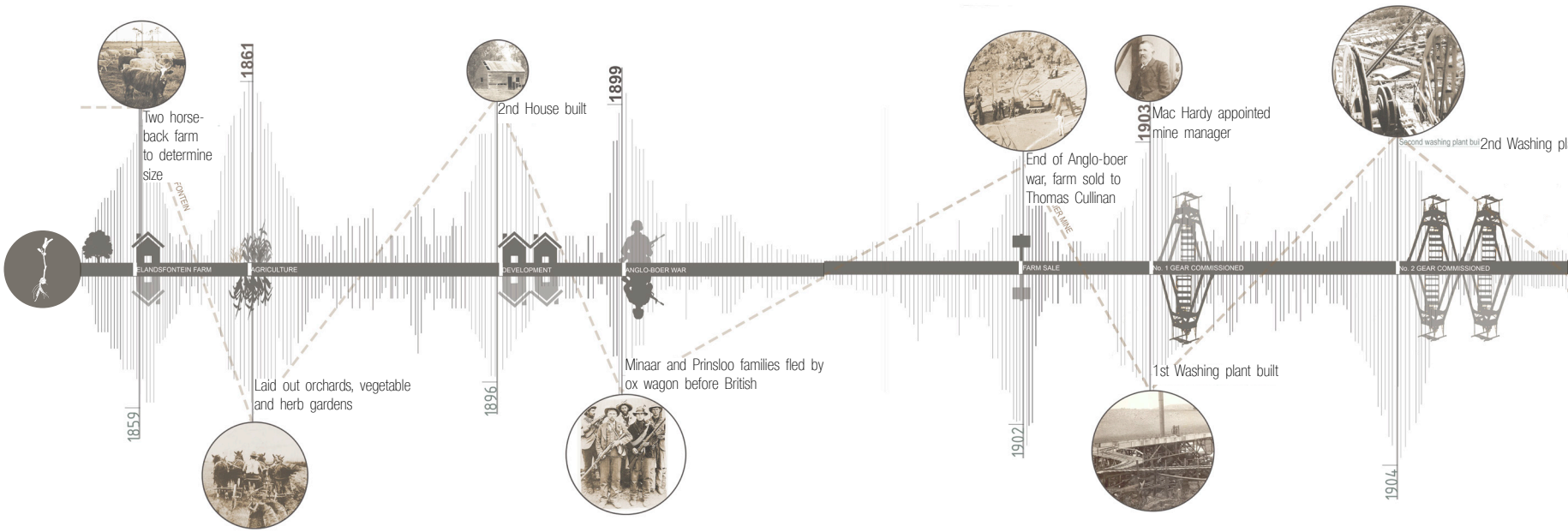
2.16 _Underground mining operations in the 1950's (Cullinan Group, 2014).

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FROM SEED TO DECOMMISSIONED MACHINE /

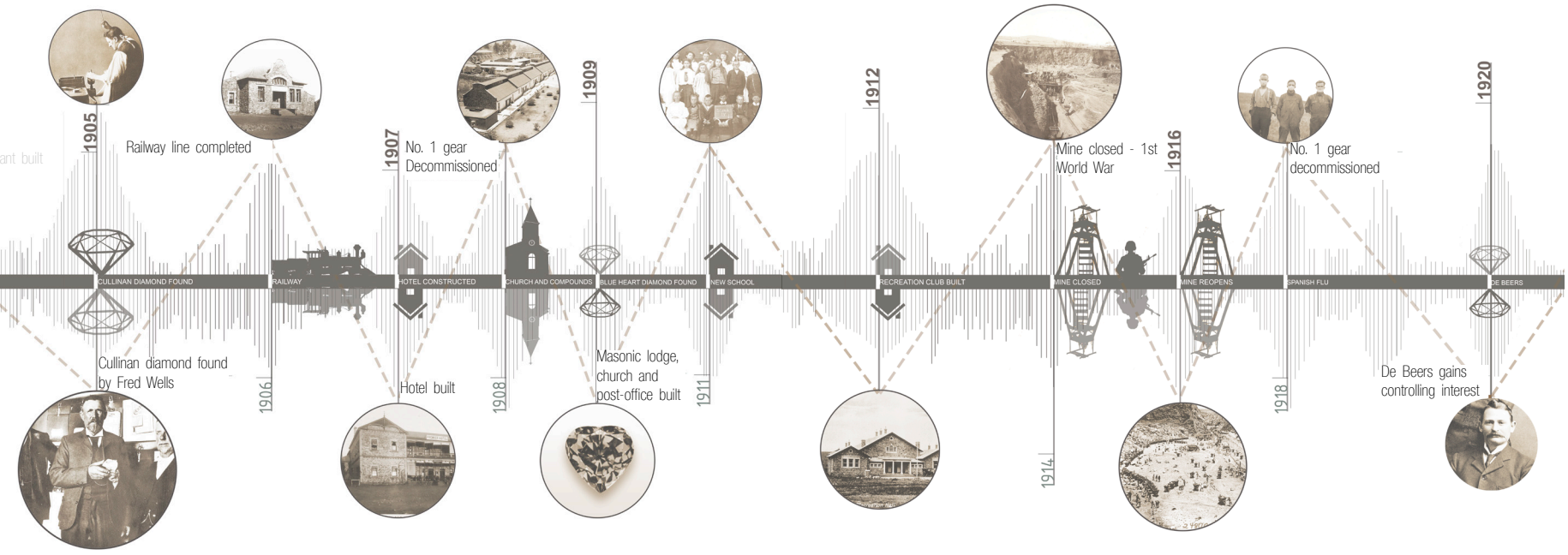
DEVELOPMENT OF CULLINAN OVER TIME:

The following time line shown in **Figures 2.17** to **2.18** depicts the development of Cullinan over time, from an agricultural farm to a mechanized industrial diamond mine. Significant historical events that had an influence on the development of the town intersect and alter the time line at the moments of their occurrence.

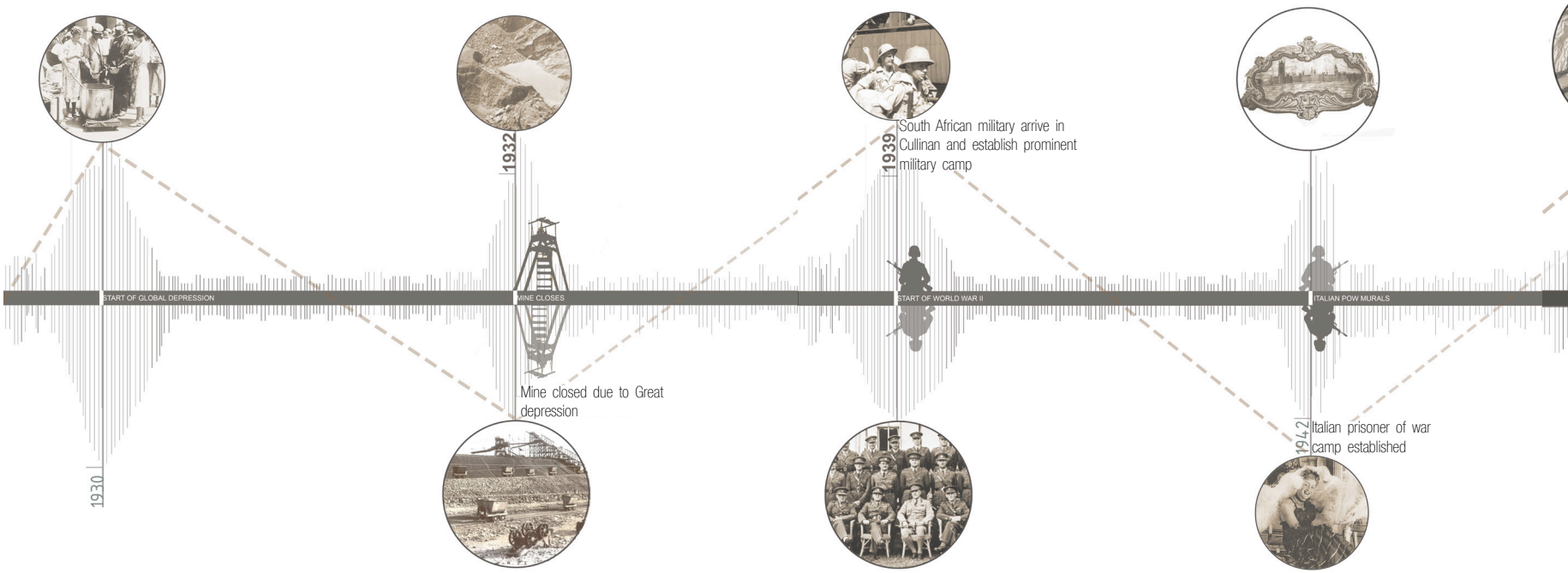


2.17 _ Cullinan time line 1859 - 1920 (Cullinan Framework Group: 2014, edited by author)

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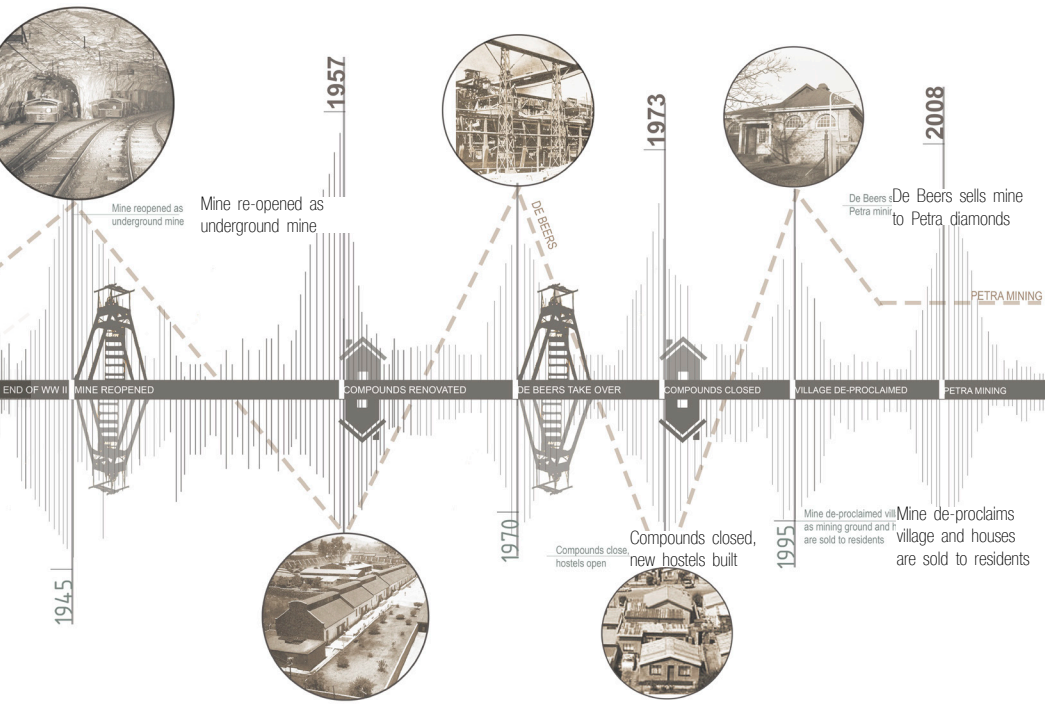


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2.18 _ Cullinan time line 1930 - 2031 (Cullinan Framework Group: 2014, edited by author).

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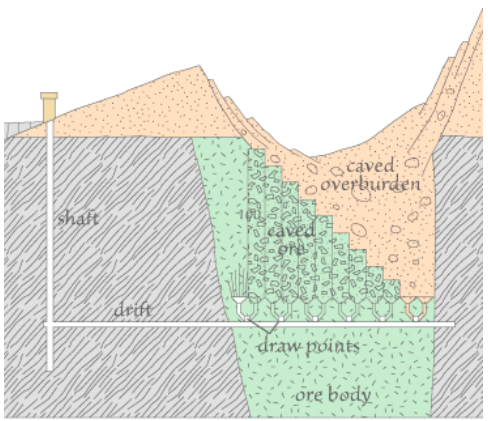
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2.19 _ Washing plant constructed in 1948 (Author: 2014).



2.20 _ No. 1 Shaft and headgear constructed in 1948 (Author: 2014).



2.21 _ Block cave mining method currently employed at the Cullinan diamond mine (Petra diamonds: 2014, edited by author).



2.22 _ Restaurants within the historical houses in Cullinan. (Labuschagne: 2013; edited by author)



2.23 _ Tours of the mine and underground workings that are currently offered to tourists (Author: 2014)

At the Cullinan Diamond Mine a new main plant to extract and wash ore from the new underground mining operations was constructed in 1948 and is still being used today as a washing plant. This washing plant and the No. 1 Shaft and Headgear are shown in **Figures 2.19** and **2.20.**

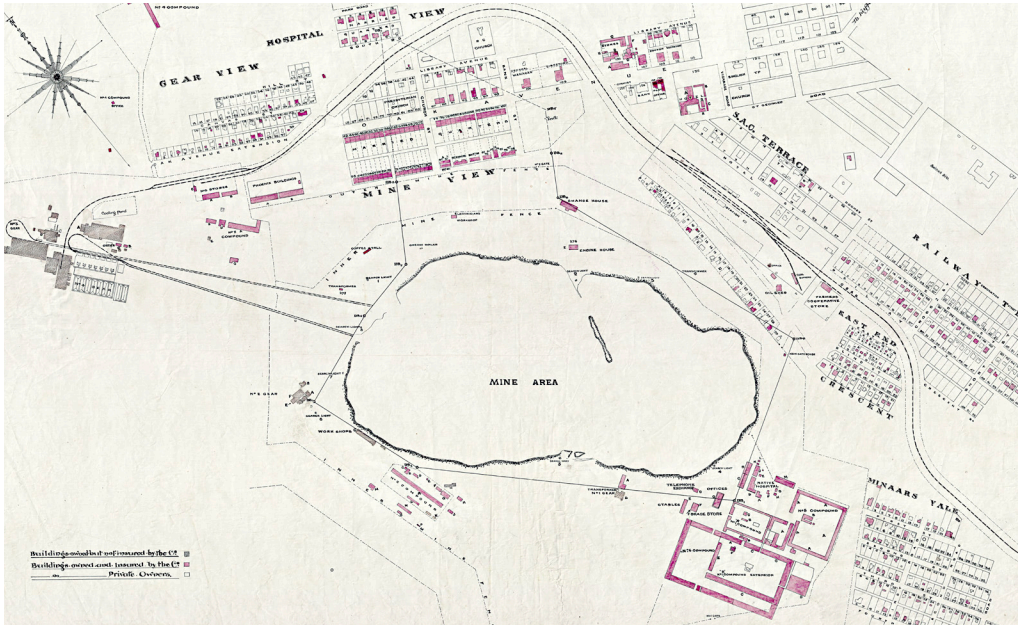
In 1970 De Beers obtained full ownership of the mine.

Petra Diamonds acquired a 37% interest in the mining operations at Cullinan from De Beers in 2008. In 2009 this was increased to 74%. Currently Petra continues its mining activities underground, using the block cave mining method shown in **Figure 2.21** (Petra Diamonds 2014).

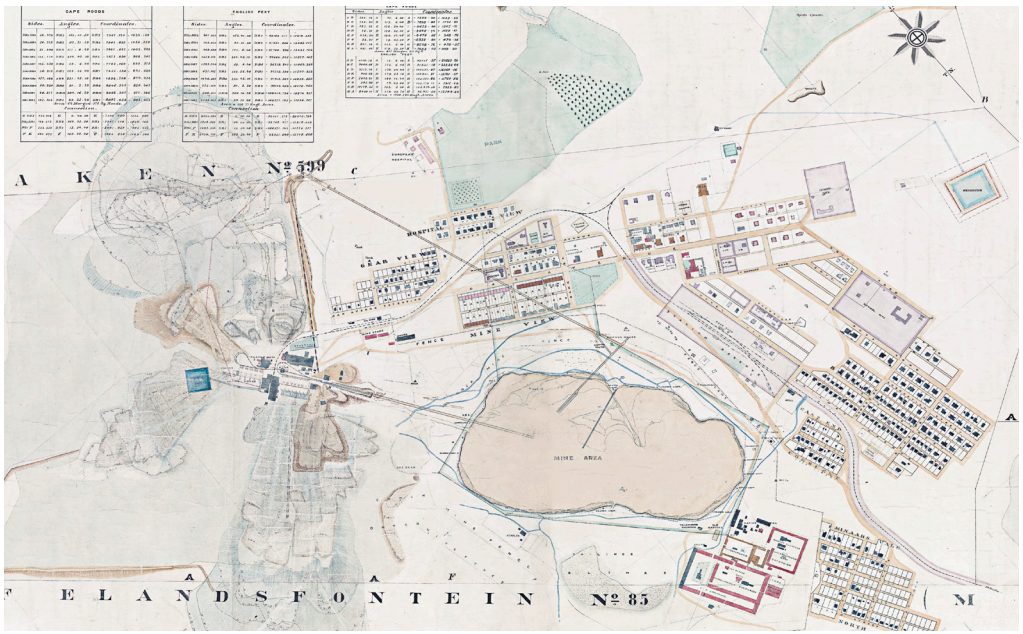
According to Petra Diamonds the mine currently has a life of 17 years, after which it will be closed and mining operations decommissioned (Petra Diamonds 2014).

Today Cullinan is a popular culinary and tourist destination for local and international visitors and tourists, as it is situated close to Pretoria and Johannesburg. Tourism is currently the second largest source of employment for the local population after the mine. A variety of guest houses, restaurants and museums have opened up in the town, many in the historical houses, to cater for these tourists (see **Figure 2.22**). Tours of the mine, the town and the underground mining operations are currently offered to visitors (see **Figure 2.23**).

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2.24 _ A surface plan of the mine and adjacent town in 1910. (Lincoln: 2011)



2.25 _ A surface plan showing the development of the mine and town by 1931 (Lincoln: 2011).

DEVELOPMENT OF THE TOWN IN RELATION TO THE MINE:



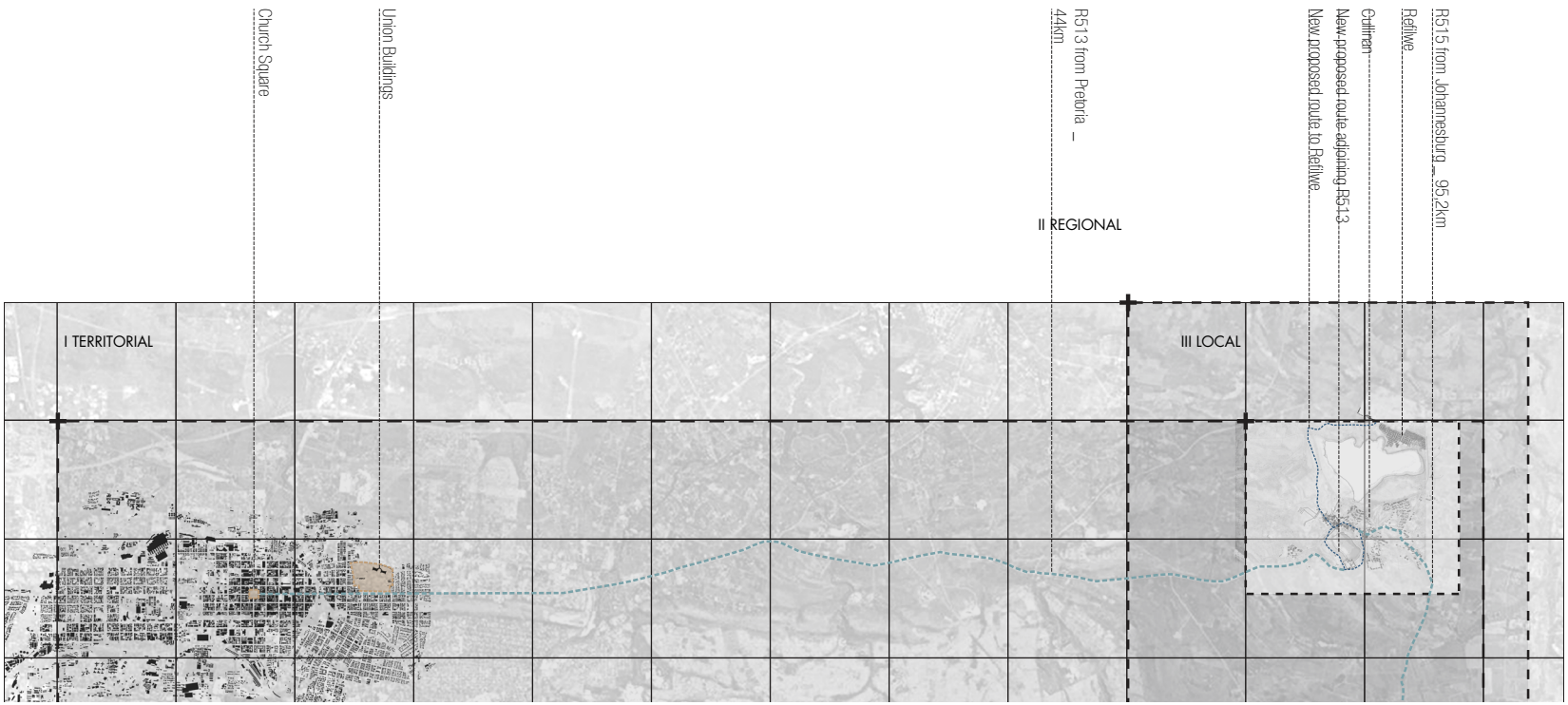
2.26 _ Development of the mine over time (Cullinan Framework Group: 2014).

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MACRO ANALYSIS/ URBAN SCALE

SITE LOCATION :

Cullinan is a small town situated 44km northeast of the Pretoria Central Business District (CBD). It is currently a popular tourist and culinary destination on the threshold between the urban and the rural. The discovery of diamonds on Elandsfontein farm 480 JR in1899 is what gave rise to the economic stability of Cullinan. Since the discovery of various diamond pipes around the world it has been determined that the geological rock formation of the Cullinan diamond pipe indicates that it is the oldest known diamond pipe in the world (Cullinan Diamond Tours: 2014) Diamonds are, however, a non-renewable natural resource, and therefore their depletion over time is inevitable. The Cullinan mine is to be decommissioned within the next 17 years, with complete deindustrialization and rehabilitation taking place over the next 48 years.

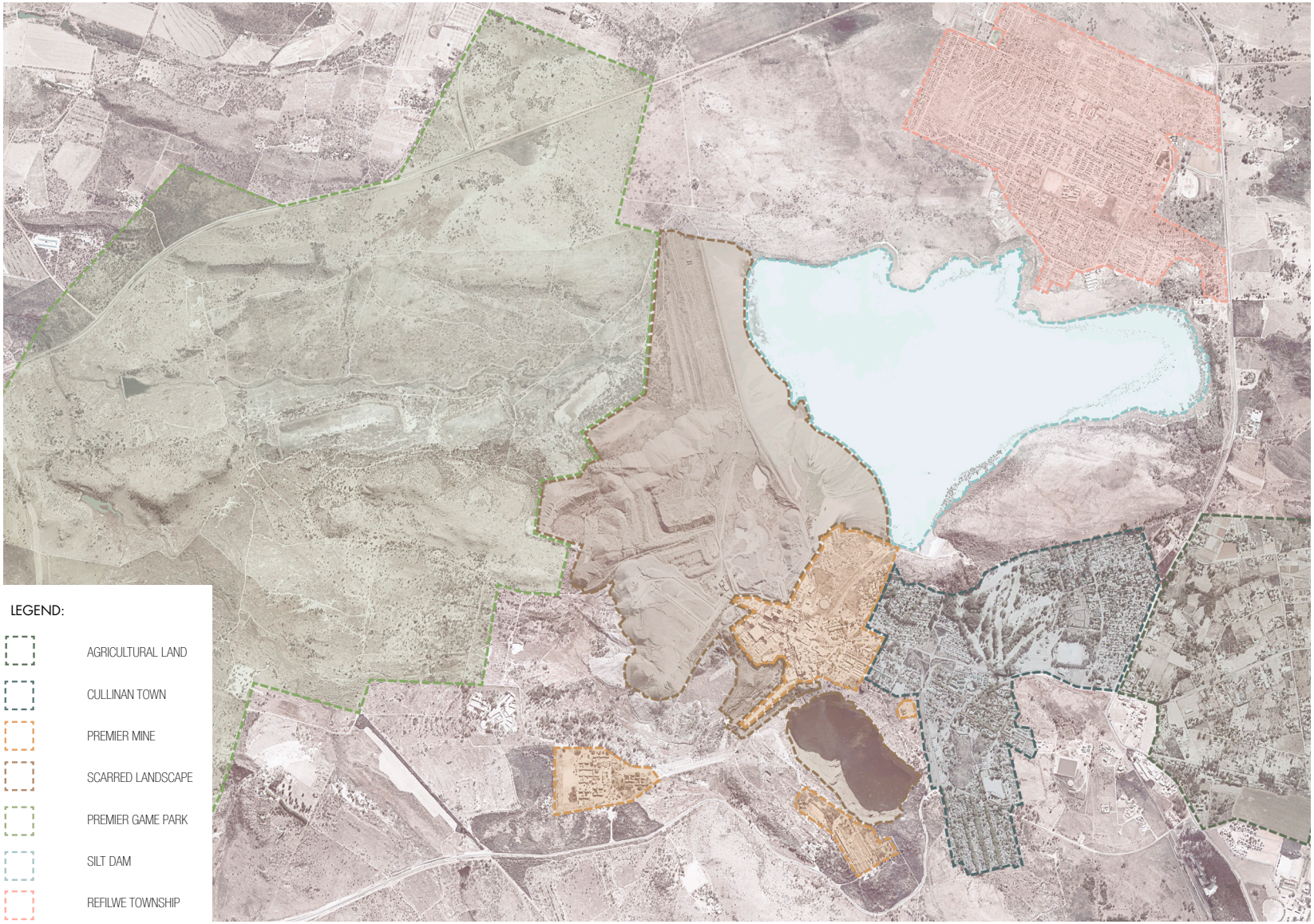


2.27 _ Locality plan (Author: 2014).

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MACRO ANALYSIS/ZONING

Showing the relationship between various land-use zones and the extent and location of the Premier Game Park.

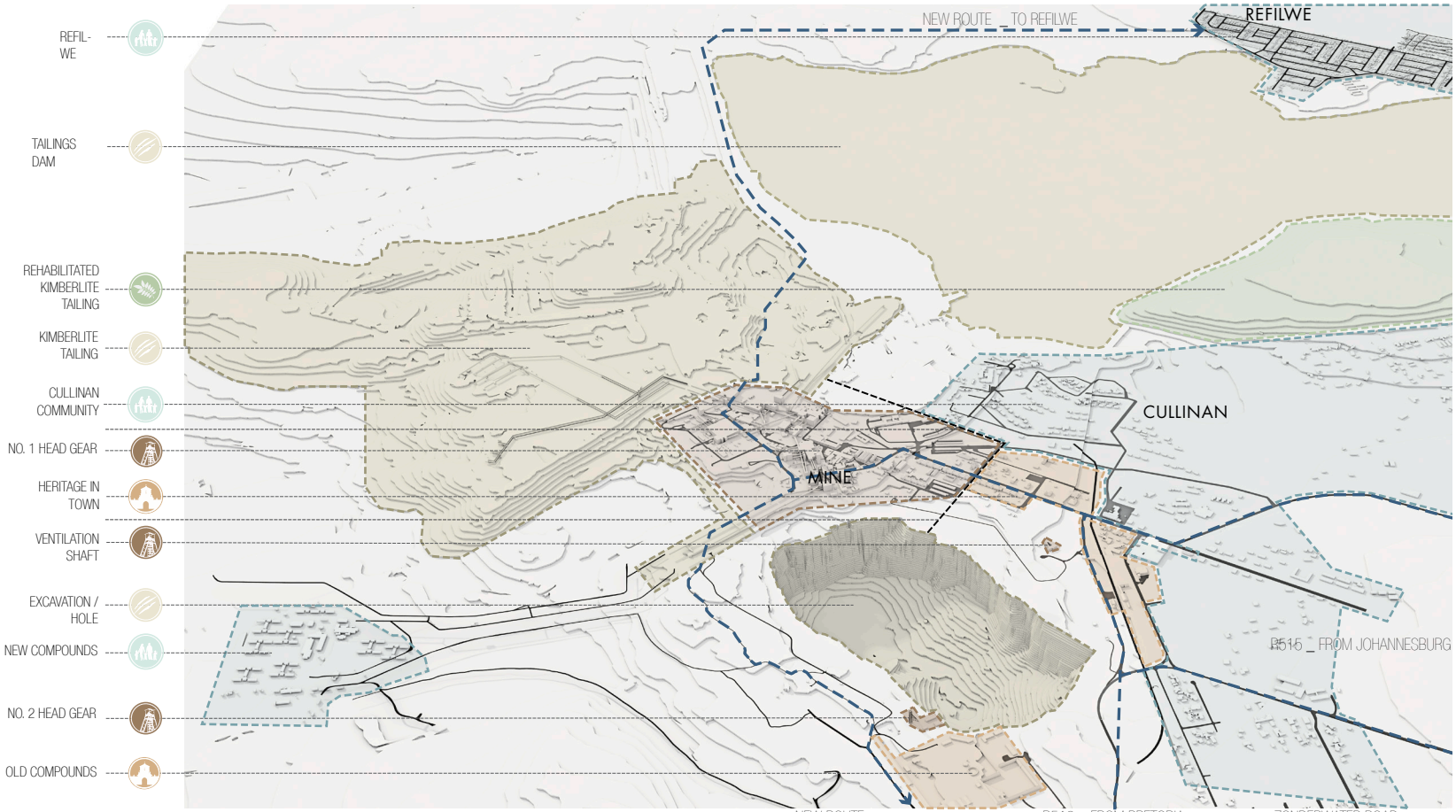


2.28 _ Locality plan (Author: 2014).

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MACRO ANALYSIS/ INFRASTRUCTURE, ECOLOGICAL, CULTURAL AND SOCIAL COMPONENTS:

Figure 2.29 shows the relationship between the various components in Cullinan and how they are connected by the existing infrastructure. It becomes apparent that this relationship is fragile with the mine as the catalytic core of production being the central element that ties together the various elements. Its decommissioning will therefore result in a fragmentation causing a decline in ecological, social, cultural and economic conditions.

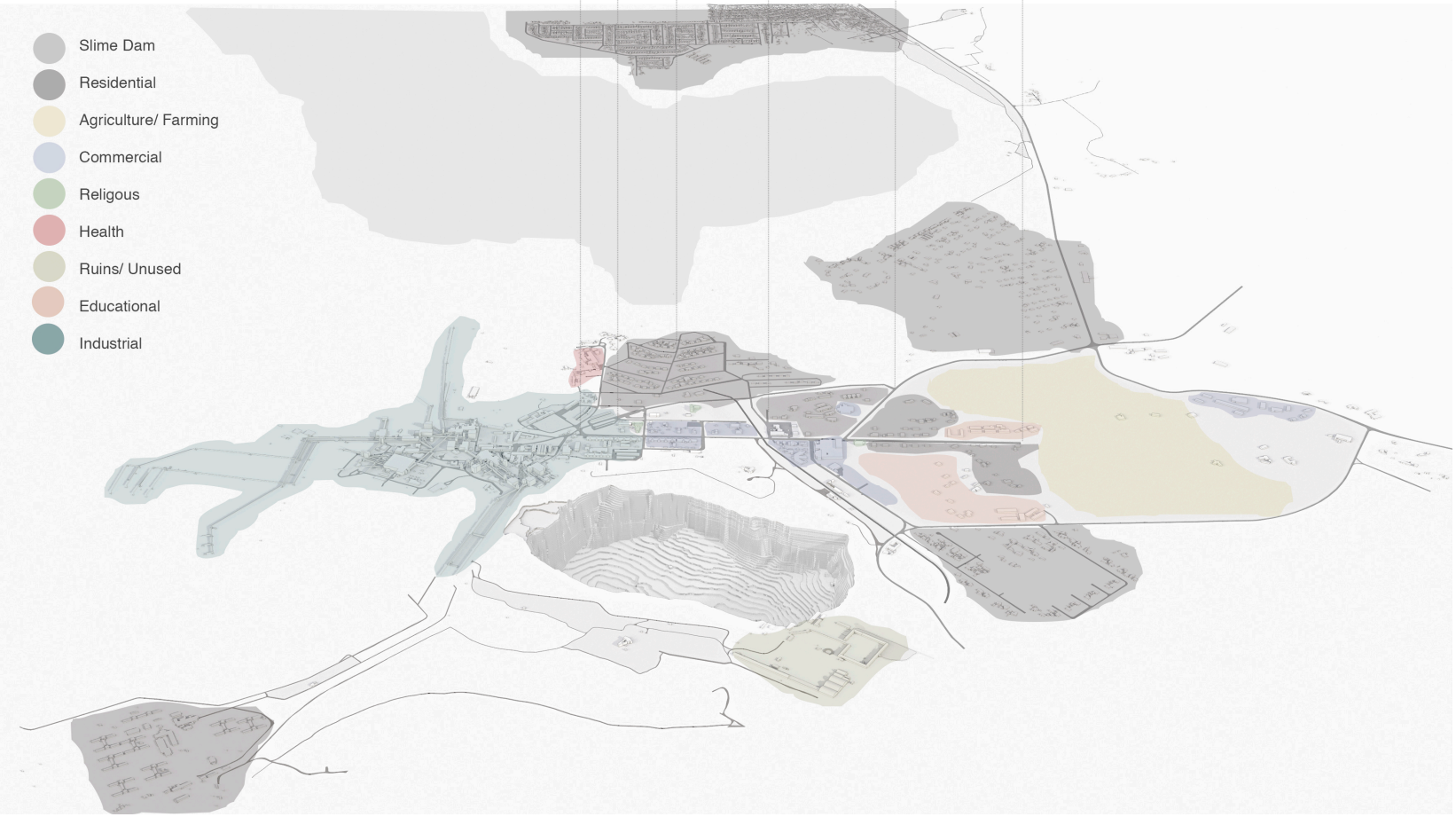


2.29 _ SHOWING INFRASTRUCTURE AND CONTEXT (AUTHOR: 2014).

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MACRO ANALYSIS/ LAND USE WITHIN CULLINAN:

Showing the extent of the mine in relation to the historical town, new residential developments, the Refilwe township, the mine workers hostels and agrarian practices.



2.30 _ Land use (Author: 2014).

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MACRO ANALYSIS / PRECINCT SCALE _ ANALYSIS OF THE HISTORICAL FABRIC WITHIN THE TOWN AND THE SERVICE AREA OF THE MINE

Largely Work
Little Tourism

Largely Tourism
Little Work

Only Tourism

Soft Space

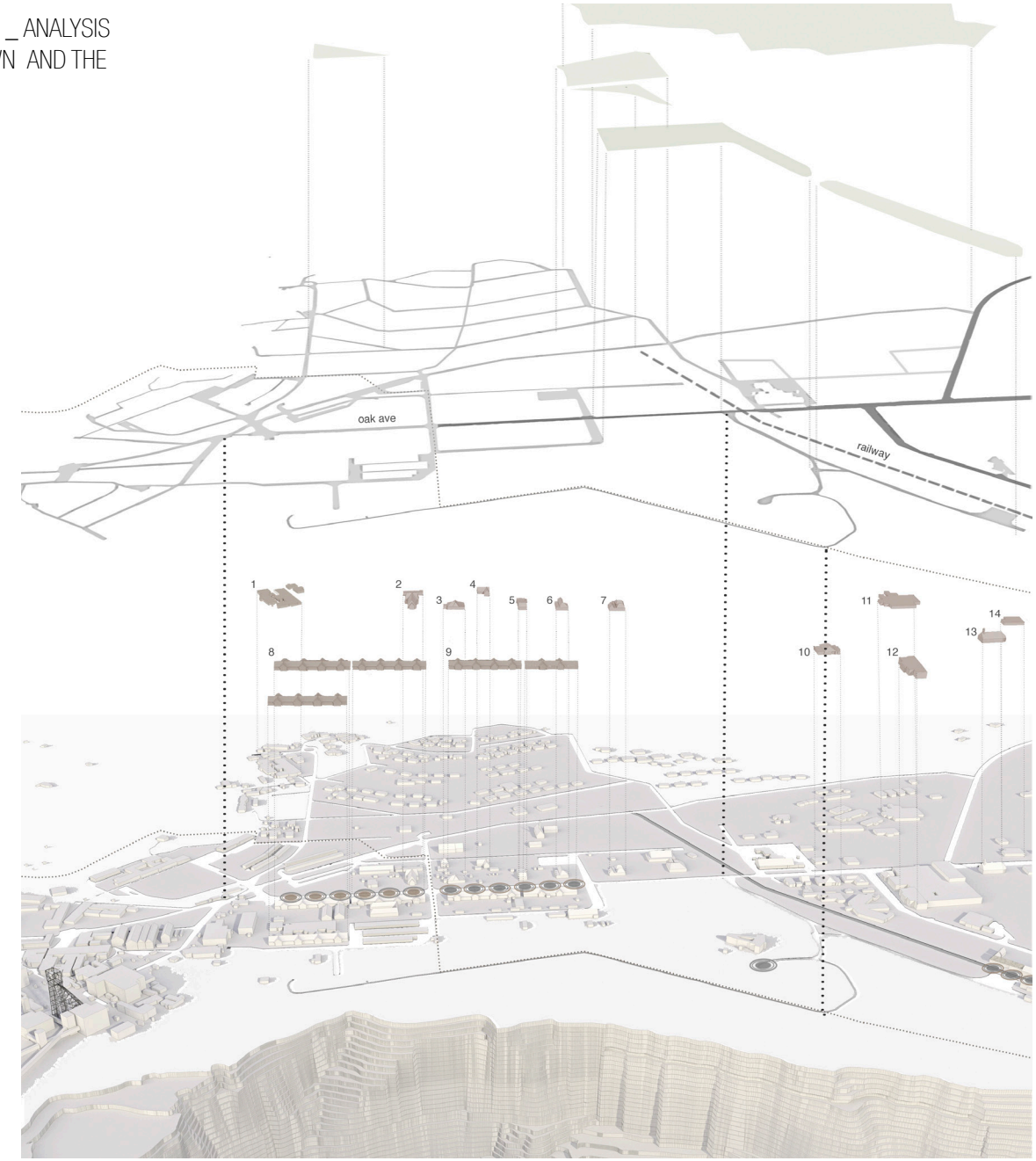
Main Roads

Secondary Roads

Railway

Edge Line

1 Hospital
2 Presbyterian Church 1908
3 Diamond Museum 1983
4 Diamond Museum 1983
5
6 Cullinan Info Office 1905
7 Mchardy House Museum 1903
8 Mine Offices
9 Tourist Shops and Restaurants
10 Nedbank Building
11 Recreation Building 1912
12 Premier Hotel 1900
13 Anglican Church 1908
14 Masonic Lodge 1909



2.31 _ Analysis of the historical fabric within the town and the service area of the mine (Author: 2014).

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2.32 _ Open-pit excavation from existing viewpoint (Author, 2014).

ECOLOGICAL CONDITION/ THE OPEN-PIT EXCAVATION:

To enable the extraction of diamonds a large scar was made in the landscape as shown in figure . The scarred landscape created by this destructive industrial practice is manifested as an enormous open-pit excavation, extensive kimberlite tailings, and a contaminated silt dam. The closure of the mine will lead to the further degradation of the ecology at Cullinan.



2.33 _ Open-pit excavation from viewpoint within the mine (Author, 2014).

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ECOLOGICAL CONDITION/ KIMBERLITE TAILINGS:

Kimberlite is the ore from which diamonds are extracted existing as an extinct volcanic pipe which brought diamonds up from deep within the mantel of the earth. The Cullinan Kimberlite pipe is the largest known Kimberlite intrusion in South-Africa. After being processed to extract the diamonds the remaining Kimberlite ore is conveyed and dumped to form enormous kimberlite tailings. These kimberlite tailings have a very high clay content and are infertile and therefore disrupt the natural ecosystem of the area. These tailings result in a host of environmental issues such as soil erosion and the contamination of natural water bodies.



2.34 _ Kimberlite tailings and silt dam in background (Author, 2014).



2.36 _ Kimberlite tailings from service road (Author, 2014).



2.35 _ Kimberlite tailings showing soil erosion due to rain (Author, 2014).



2.37 _ Kimberlite tailings at surplus storage (Author, 2014).

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ECOLOGICAL CONDITION/ SILT DAM

The silt dam was created to store the contaminated water that is a by-product of diamond mining. This water contains a fine kimberlite clay sediment as a result of washing the diamonds out of the kimberlite ore. Although the water is non-toxic, diamond mining being a gentleman's mining practice and not requiring the use of chemical to extract diamond, the fine sediment prevents it from being used as potable water. Currently a water treatment plant is being constructed to remove the fine sediment from the water and purifying it. By merely employing a sediment filter this water body provides significant potential to be utilized as a water source for agricultural practices.



2.38 _ Pipeline pumping tailings into silt dam (Author, 2014).



2.39 _ Vetiver grass used to control runoff at silt dam (Author, 2014).

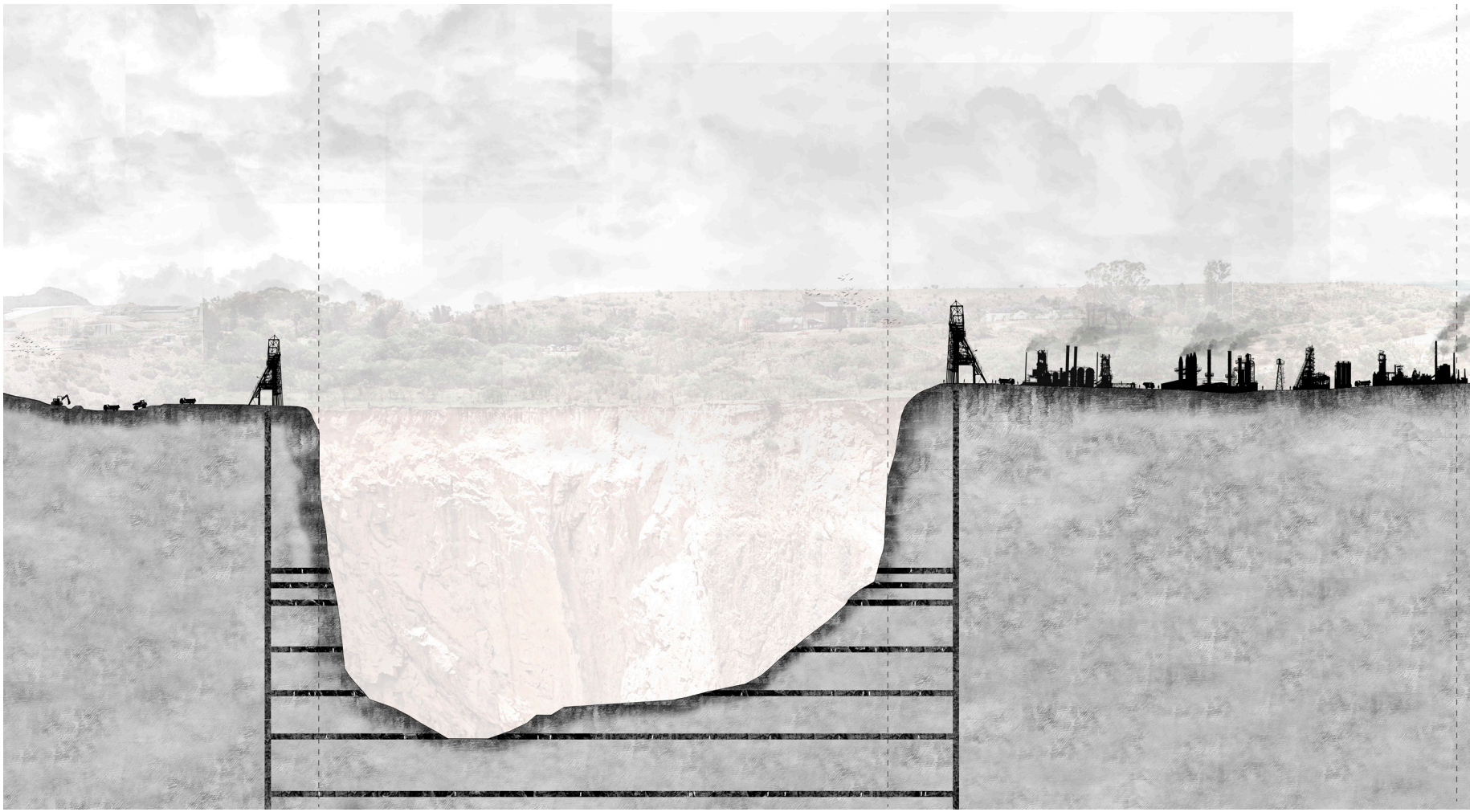


2.40 _ Aerial view showing extent of silt dam (Author, 2014).

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LAND FORM:

The following section was drawn to scale to illustrate the differences in scale between the open-pit excavation, the mining buildings and structures, and the town of Cullinan. The scale decreases significantly as the urban fabric unravels into the surrounding agrarian and natural landscape.



2.41 _ Section of open-pit excavation and surrounding environment (Author, 2014).

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MICRO ANALYSIS/ AREA OF FOCUS

The chosen site is located within the mine at Cullinan, focusing on the area around the No. 1 Shaft and Headgear. This site was selected as the study area due to its significant industrial heritage value and the fact that the No.1 Headgear already serves as a landmark and orientation point within Cullinan.

2.42 _ Aerial photograph of Cullinan showing area of focus (Google Earth<http://www.google.com/earth/>, edited by author)



2.43 _ Aerial photograph showing the site (Mc Gill: 2014, edited by author).

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MICRO ANALYSIS/ PHYSICAL CONDITIONS:

Within the area under investigation three different physical conditions exist, namely:

- The industrial heritage buildings and structures
- The natural landscape
- The scarred landscape
- The open-pit excavation

The chosen site, which currently exists as a waste rock dumping site, is a neglected open area which has the most potential for architectural intervention. This due to its central location being positioned in the middle of the various site conditions allowing it to function as a mediator between them.

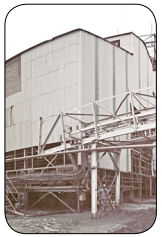


2.44 _ Birds eye view photograph of Cullinan mine showing area of focus (Mc Gill, 2014, edited by author)

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MICRO ANALYSIS/ HERITAGE VALUE

WASHING PLANT:

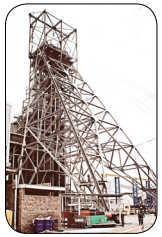


VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting needs to be replaced
Structural steel portal frames in sound condition

NO. 1 HEADGEAR AND SHAFT:



VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE
TECHNOLOGICAL VALUE
ARCHITECTURAL VALUE

AGE:
Older than 60 years

CONDITION:
Very good condition
Structure and connections requires minor maintenance

NO. 3 HEADGEAR AND SHAFT:



VALUE:
FUNCTIONAL VALUE
SOCIAL VALUE
ARCHITECTURAL VALUE

AGE:
Younger than 20 years

CONDITION:
Very good condition
Structure and connections need minor maintenance

WINDER HOUSE BUILDING:



VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting needs to be replaced in some areas
Portal frames and purlins in sound condition

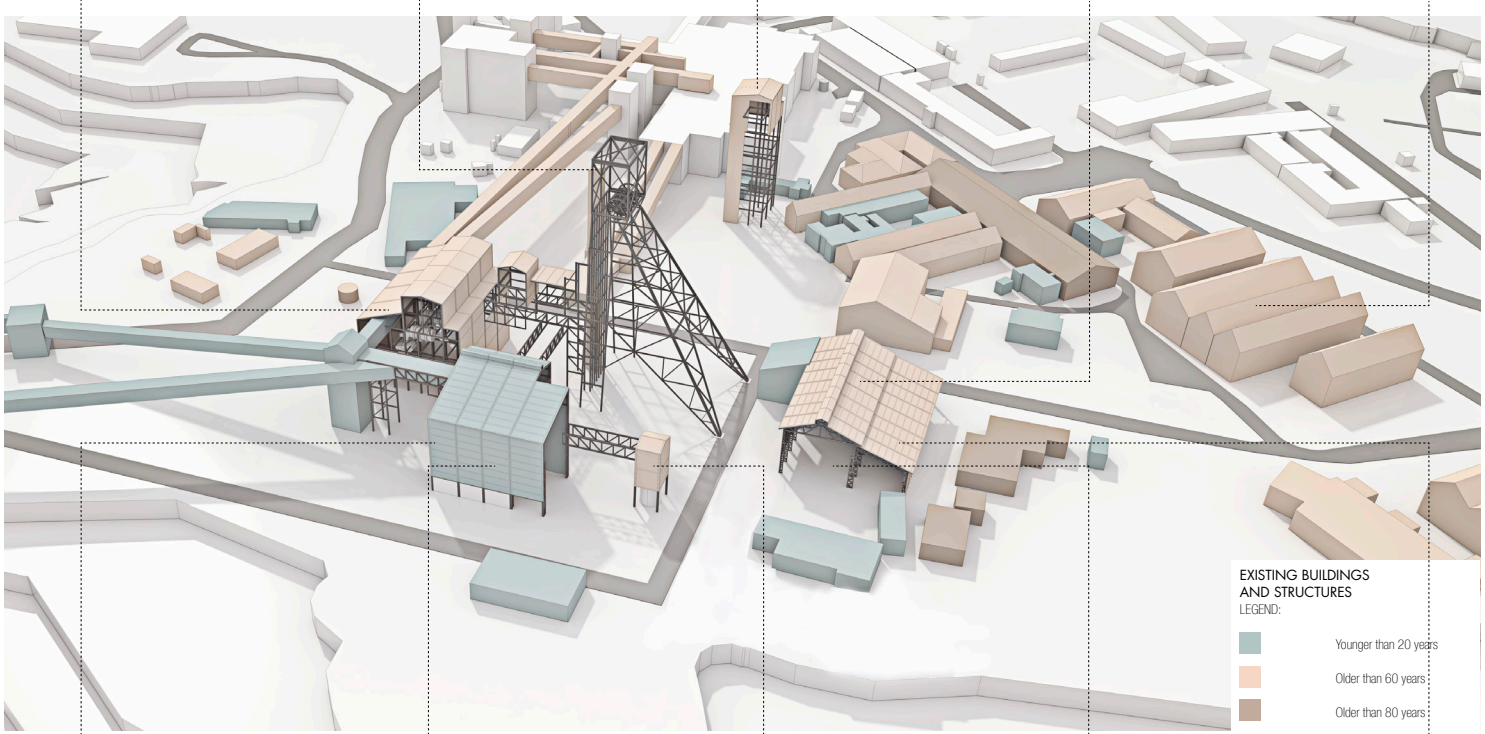
HISTORICAL WAREHOUSES:



VALUE:
HISTORICAL VALUE
SOCIAL VALUE
ARCHITECTURAL VALUE

AGE:
Older than 80 years

CONDITION:
Fair condition, All metal sheeting needs to be replaced, Portal frames and purlins in fair condition, requires maintenance



CHUTES AND SCRUBBERS:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION OR ADAPTIVE RE-USE

AGE:
Younger than 20 years

CONDITION:
Very good condition
Possibility - adaptive re-used

CRUSHER BUILDING:



VALUE:
FUNCTIONAL VALUE

AGE:
Younger than 20 years

CONDITION:
Good condition
Metal sheeting needs to be replaced in some areas
Structural steel framework and portal frames in sound condition

WATER AND PUMPING TOWER:

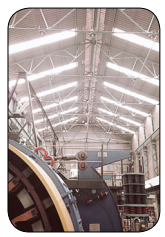


VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting in good condition
Structural steel framework in sound condition

ORE HOISTING MACHINERY:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION

AGE:
Older than 60 years

CONDITION:
Good condition
Requires some maintenance

M.G. SET MACHINERY ROOM:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION

AGE:
Older than 60 years

CONDITION:
Good condition
Requires minor maintenance

2.45 _ Showing an analysis of the heritage value of the various buildings and structures around the No. 1 shaft and headgear(Author, 2014)

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MICRO ANALYSIS/ PHOTOGRAPHIC STUDY

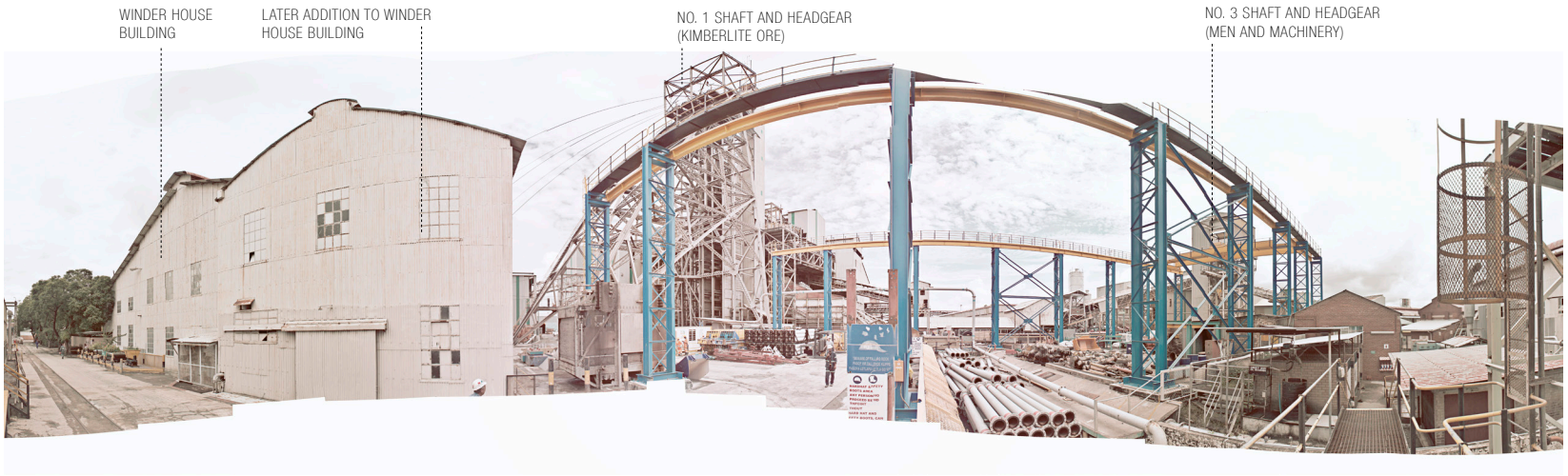


2.46 _ No.1 Shaft and headgear, crushing building and water pumping tower (Author, 2014)

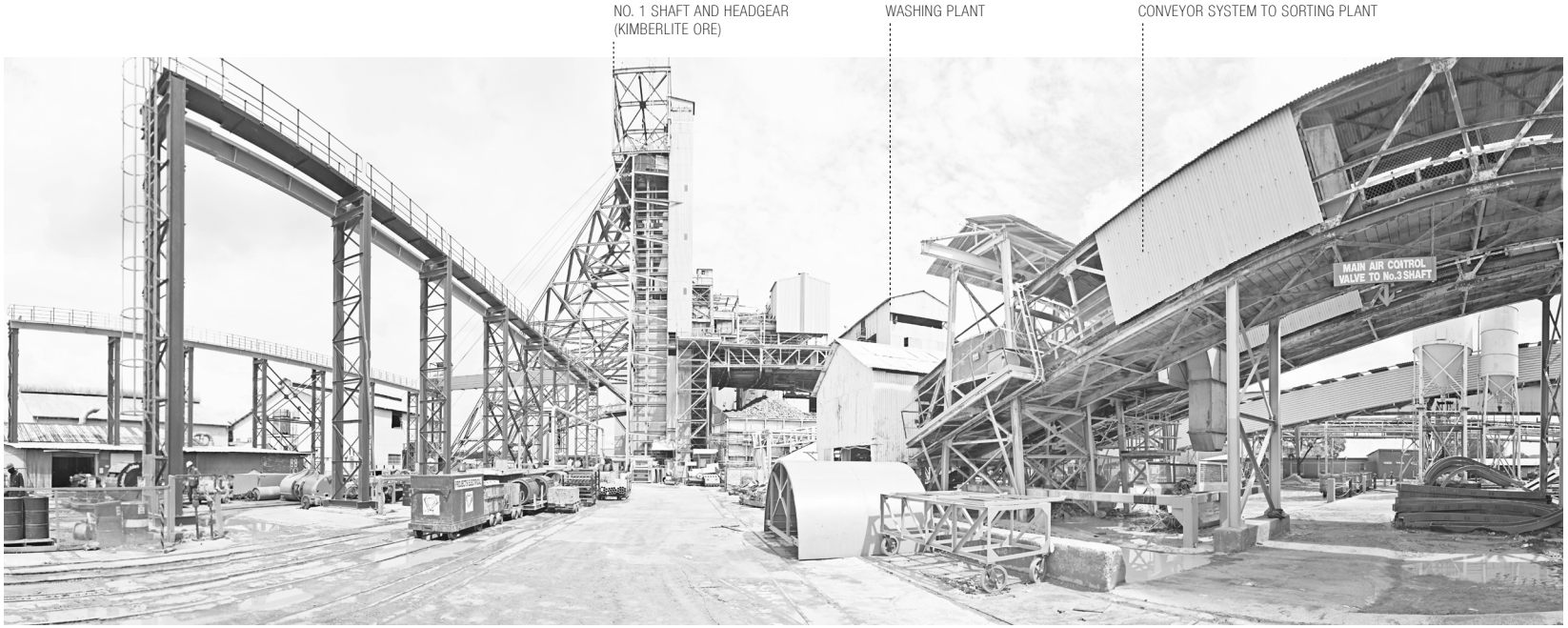


2.47 _ Crushing building, conveyor system connecting crushing building with surplus kimberlite storage and washing plant in background (Author, 2014)

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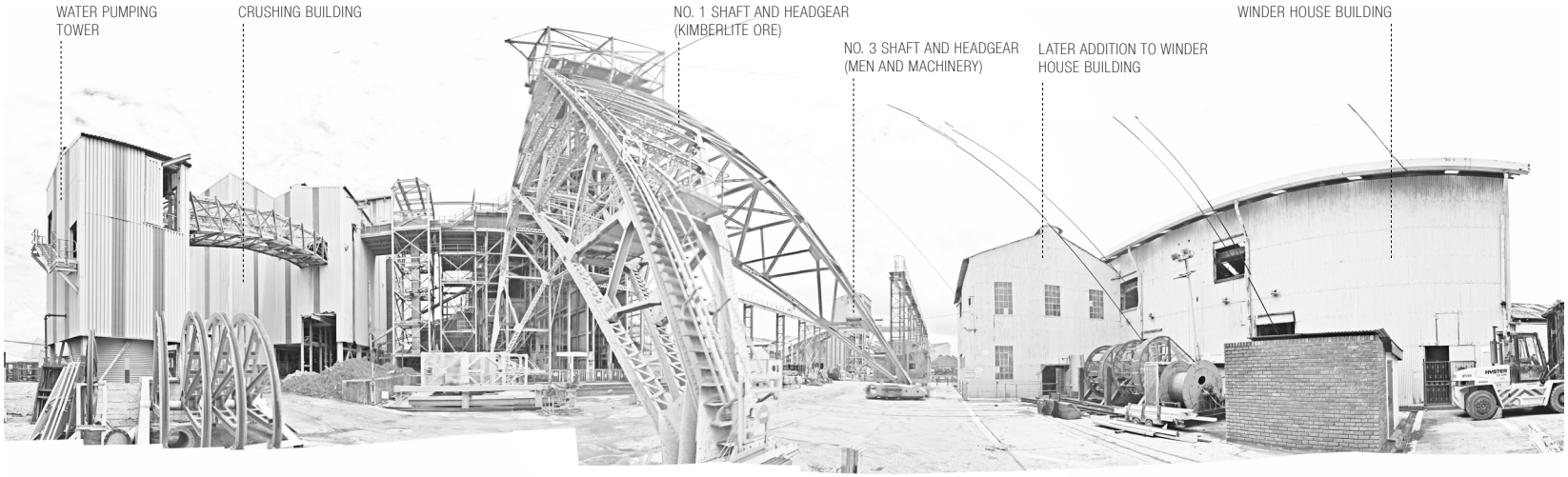


2.48 _ No.1 Shaft and headgear, hoisting building and No. 3 shaft and headgear in background (Author, 2014)

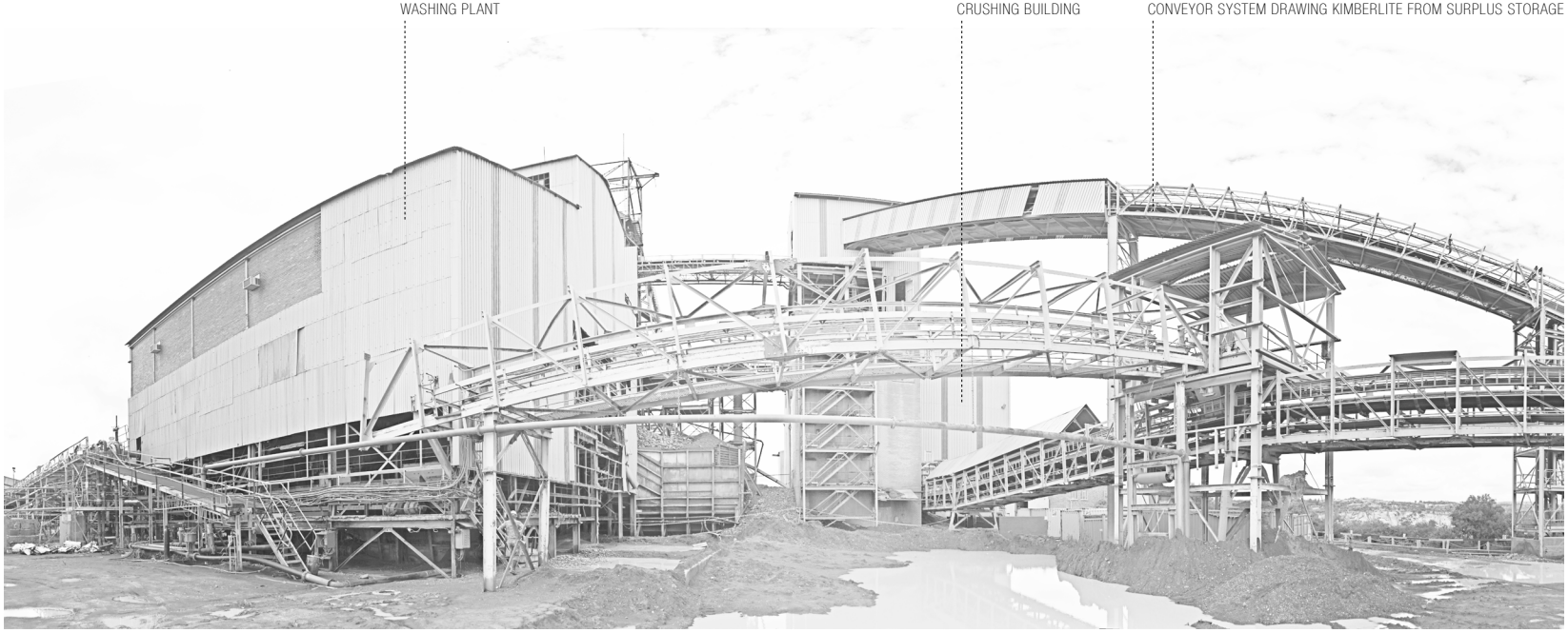


2.49 _ No.1 Shaft and headgear, washing building and conveyor system (Author, 2014).

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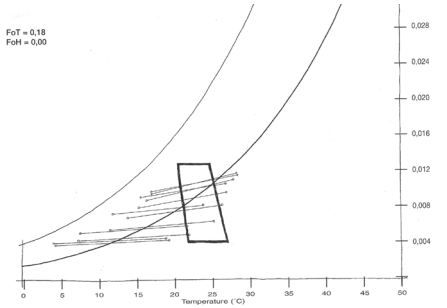
2.50 _ No.1 Shaft and headgear, crushing building, water pumping tower and winder house building (Author, 2014).



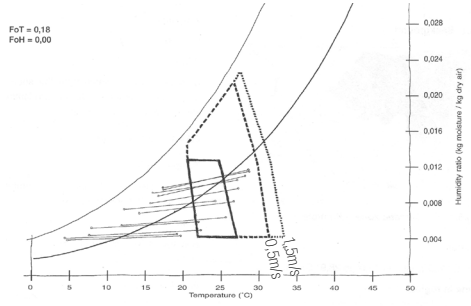
2.51 _ Washing plant and connecting conveyor systems (Author, 2014).

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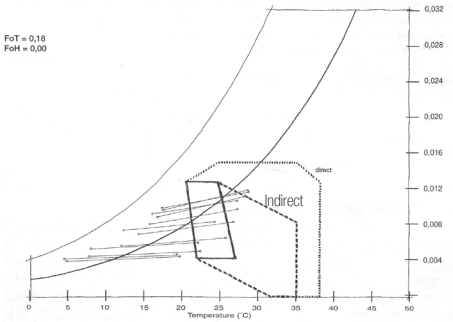
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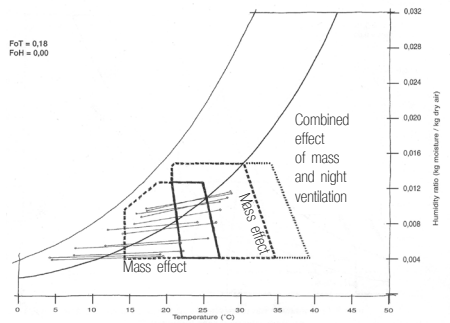
2.52 _ Psychrometric chart showing the zone of human comfort relative to the climate at Cullinan (Holm, 1996).



2.53 _ Psychrometric showing the effect of 0,5m/s and 1,0m/s ventilation on human comfort (Holm, 1996).



2.54 _ Psychrometric showing the effect of direct and indirect evaporative cooling on human comfort (Holm, 1996).



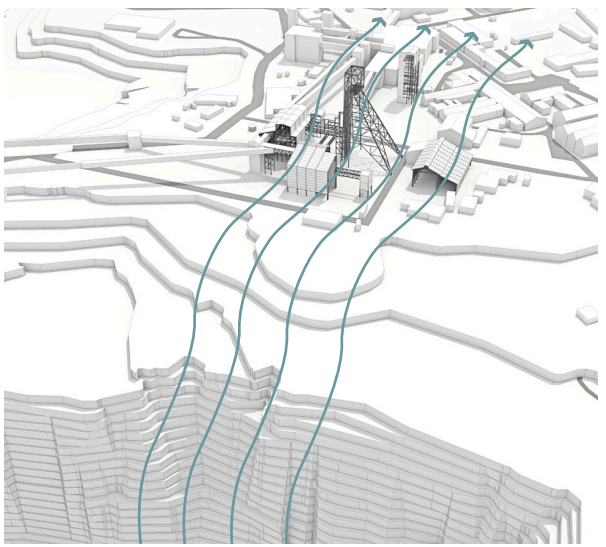
2.55 _ Psychrometric showing the effect thermal mass and night ventilation on human comfort (Holm, 1996).

MICRO ANALYSIS/ CLIMATIC CONDITIONS _ TEMPERATURE AND PRECIPITATION

According to Holm(1996: 69) the climatic zone within which Cullinan is located is characterized by distinct rainy and dry seasons with a large daily temperature variation and intense solar radiation (see figure). Humidity levels in this area is moderate. Cooling during summer is therefore more important than heating in winter, which are relatively moderate in temperature. Pedestrians are to be provided with protection from solar radiation trough trees, arcades and canopies. Due to the moderate humidity levels, direct evaporative cooling methods is effective for most of the overheated period. External spaces need to be provided with shade in summer for outdoor activities while providing western facades with buffer zones or vertical shading. Thermal mass is effective for approximately half of the under-heated period and the entire overheated period and can be provided by utilizing walls and floors with a high thermal mass. The open-pit excavation functions as a natural stack when its surface consisting of felsite rock and having a high thermal mass, heats up through solar radiation. The heat is radiated, causing temperature of the air within the excavation to rise and resulting in an updraft as shown in **Figure 2.56** that can be harnessed to naturally ventilate spaces.

	TEMPERATURE:				PRECIPITATION:		
MONTH:	HIGHEST RECORDED:	AVERAGE DAILY MAXIMUM:	AVERAGE DAILY MINIMUM:	LOWEST RECORDED:	AVERAGE MONTHLY (mm):	NUMBER OF DAYS >== 1mm:	HIGHEST 24hr RAIN-FALL (mm)
JANUARY	36	29	18	8	136	14	160
FEBRUARY	36	28	17	11	75	11	95
MARCH	35	27	16	6	82	10	84
APRIL	33	24	12	3	51	7	72
MAY	29	22	8	-1	13	3	40
JUNE	25	19	5	-6	7	1	32
JULY	26	20	5	-4	3	1	18
AUGUST	31	22	8	-1	6	2	15
SEPTEMBER	34	26	12	2	22	3	43
OCTOBER	36	27	14	4	71	9	108
NOVEMBER	36	27	16	7	98	12	67
DECEMBER	35	28	17	7	110	7	50
YEAR:	36	25	12	-6	674	87	160

2.56 _ Showing annual temperatures and precipitation for each month (Holm, 1996).



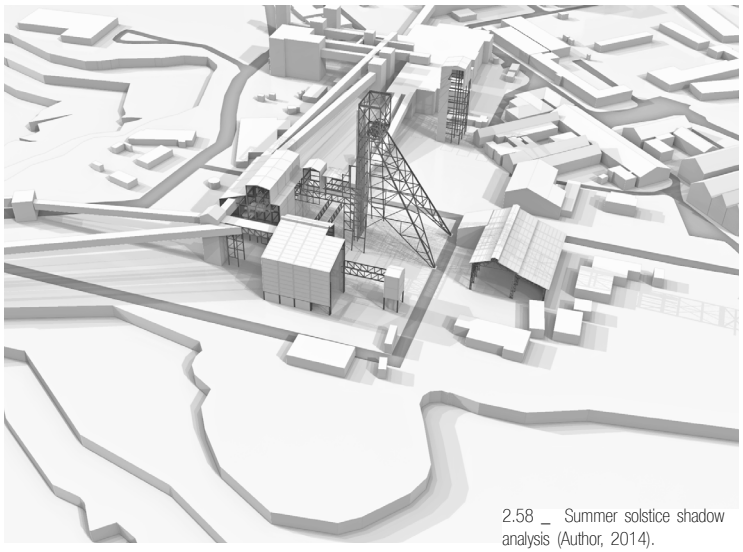
2.57 _ Showing the updraft from the excavation due to the stack effect (Author, 2014).

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MICRO ANALYSIS/ CLIMATIC CONDITIONS _
SHADOW ANALYSIS

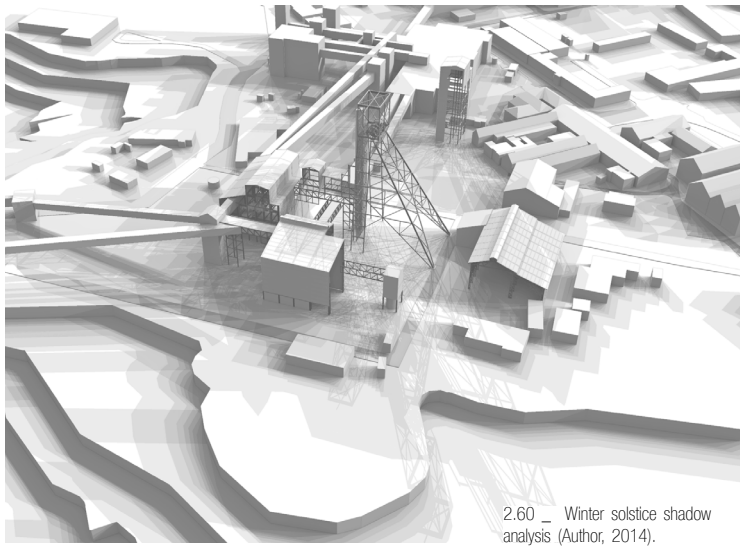
The shadow analysis shows that the area beneath and around the No. 1 shaft and headgear is shaded by the surrounded buildings throughout most of the year and can therefore be utilized as a public square without requiring additional shading.

01_SUMMER SOLSTICE _ 21 DECEMBER



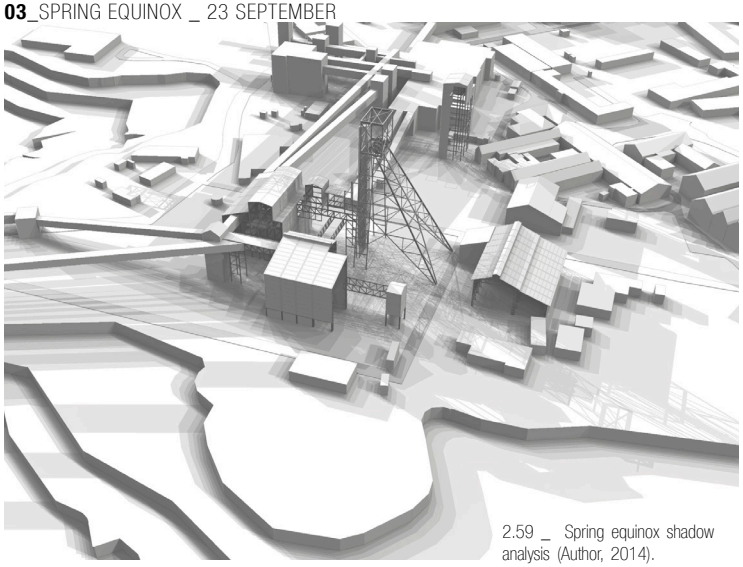
2.58 _ Summer solstice shadow analysis (Author, 2014).

02_WINTER SOLSTICE _ 21 JUNE



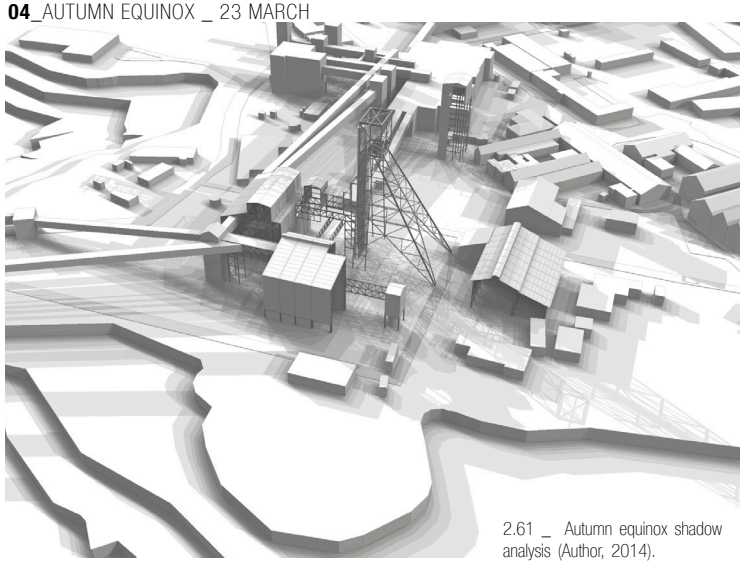
2.60 _ Winter solstice shadow analysis (Author, 2014).

03_SPRING EQUINOX _ 23 SEPTEMBER



2.59 _ Spring equinox shadow analysis (Author, 2014).

04_AUTUMN EQUINOX _ 23 MARCH



2.61 _ Autumn equinox shadow analysis (Author, 2014).

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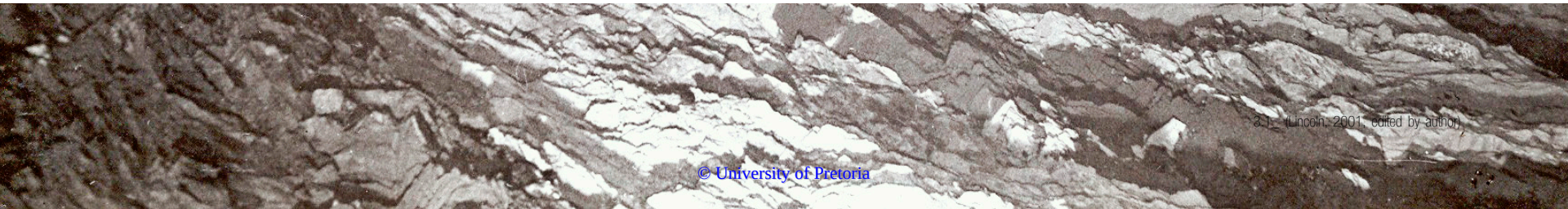
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003

CHAPTER 03 / THOUGHT, REFLECTION, FEELING _ Theoretical departure

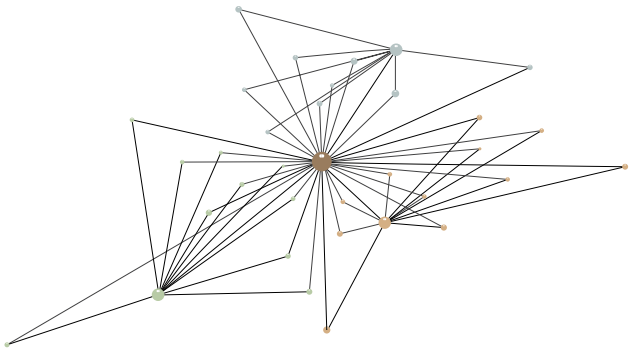


3.1: (Lincoln, 2001, edited by author)

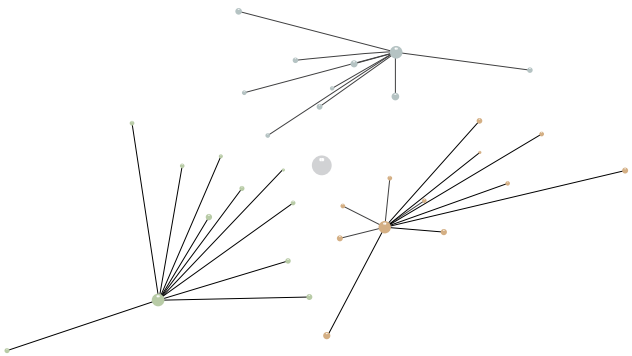
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Legend:

- Industry
- Social components
- Ecological components
- Cultural components



3.2_ Mine as a Mono-functional industry before collapse (Author, 2014).



3.3_ Mine as a Mono-functional industry after collapse (Author, 2014).

THEORETICAL DEPARTURE / 003

INTRODUCTION:

This chapter frames the argument of the dissertation from a theoretical point of view. Resilience will be investigated as an approach to understanding the nature of the mine as a mono-functional industry, and the role that new productive industries could play in establishing a sustainable, resilient future for the de-commissioned mine. An approach to the industrial heritage within the mine will be established according to the Nizhny Tagil and Burra charters. This will inform the development of the framework and the architectural response. Critical theory concerning phenomenology will then be investigated to develop a design approach that would re-establish a sense of place and an association with the industrial heritage site through sensory and spatial experience.

QUESTIONING A WORLD-VIEW:

"Old dominant perspectives have implicitly assumed a stable and infinitely resilient environment where resource flows could be controlled and nature would self-repair into equilibrium when human stressors were removed" (Folke 2006:253). This statement is particularly relevant for understanding why and how the mine developed as a mono-functional industry – with the sole purpose of extracting resources by exploiting the environment for economic gain, while disregarding the long-term effects of creating a scarred environment. This way of thinking found its genesis in a Modernist world view that is described by Du Plessis (2011: 1) as being "reductionist and mechanistic," seeing man as being separated from and superior to nature. According to Shangoni (2013: 437-438) it is currently accepted practice, as is the case at Cullinan, to merely restore the majority of the mining area to a wilderness land capability. Opposing this way of thinking, Mang and Reed (2012: 26) state that: "It is not enough to aspire to mitigate the effects of human activity – people need to take their place again as a part of nature and re-establish a connection between man and nature or the landscape." Therefore it becomes clear that the current approach to rehabilitation is fundamentally flawed in that it merely attempts to transform the scarred landscape into a constructed natural landscape, without re-establishing a connection between society and the post-industrial scarred environment.

In response to this, a new ecological world view is proposed as an alternative way of seeing and addressing the post-industrial scarred environment. Folke (2006: 259) states that an ecological world view sees the "delineation between social and ecological systems as artificial and arbitrary," and in response proposes that environments should be viewed as integrated social–ecological systems in which humans exist in nature as one of its fundamental parts. Reed (2011: 675) defines ecological systems-thinking as an approach which "recognizes that the entirety is interconnected, and moves us beyond mechanics into a world activated by complex inter-relationships – natural systems, human social systems, and the conscious forces behind their actions." The post-industrial scarred environment can therefore be understood as a complex adaptive system "in which humans co-evolve with other entities" by establishing a mutualistic relationship with them (Du Plessis 2011: 1). All living entities should therefore "contribute to creating a healthy and resilient social–ecological system that can regenerate itself" (Du Plessis 2011: 2).

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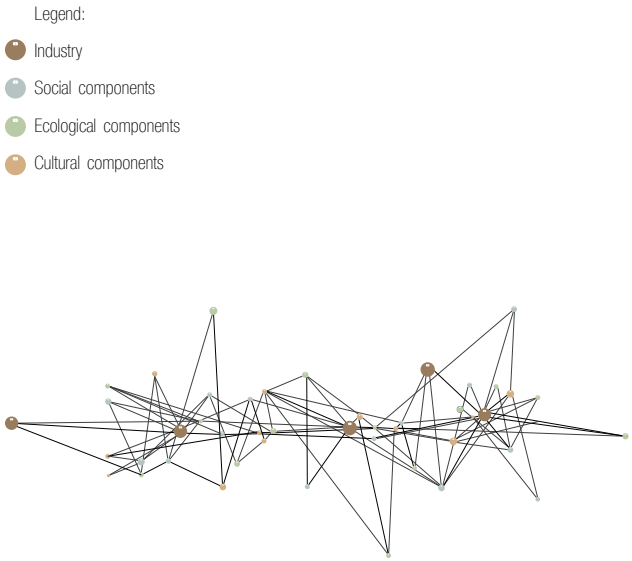
By employing the ecological world view as a lens through which the post-industrial environment can be understood, the limitations of current rehabilitation strategies can be identified and transcended to achieve resilience.

RESILIENCE:

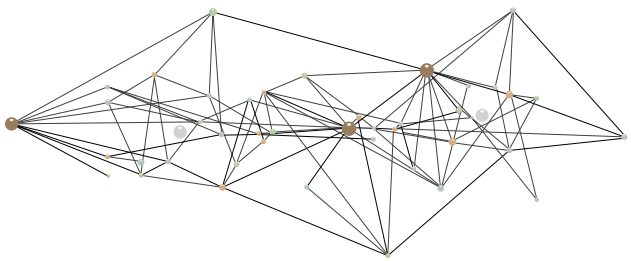
"Resilience in a complex system is defined as the system's ability to absorb stresses and shocks without losing functionality or changing structure" (Du Plessis 2013: 36). It is therefore seen as the adaptive capacity of a system to survive coming changes or disturbances and to absorb these changes without losing its purpose. According to Du Plessis (2013:37) 'resilience' was a term originally used in the fields of ecology and ecosystem management to refer to the ability of living systems to react to change and agitation by adapting to and absorbing stress in order to remain functional (Du Plessis 2013: 37). This gives rise to the question as to how the principle of resilience can be made applicable to man-made systems, such as the mine at Cullinan.

CREATING RESILIENCE IN MAN-MADE SYSTEMS:

Du Plessis (2013: 37) explains that the resilience of man-made systems – which provide critical services or sustain societies economically – can be improved by distributing functions across many smaller components of the system, rather than by relying on a singular mono-functional component. This allows a system to continue functioning without collapsing or breaking down completely if one component or part becomes redundant (Du Plessis 2013: 36). **Figure 3.2** shows the existing condition of the mine as a mono-functional industry with no interconnected relationships between ecology, society and culture. The effect of the decommissioning of the mine is shown in **Figure 3.3.** The mine will become redundant and meaningless after it has been decommissioned, which will cause the fragmentation and decline of economic, ecological and cultural conditions. Folke (2006: 253) states that a resilient approach recognizes the potential of disturbance to create an opportunity for doing new things that facilitate innovation and development. The decommissioning of the mine should therefore be perceived as an opportunity for new resilient development rather than as a threat. This introduces the question of how the mine as a decommissioned industrial site can be provided with a new resilience that would allow it to survive after its closure. Folke (2006: 259) defines resilience as "the capacity of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, feedbacks and therefore identity." In light of the fact that the mine functioned as the catalytic core of production in the area, this new resilience could be provided by establishing a network of new multi-functional productive industries within the mine. These new industries would re-establish the historical function of the mine as a productive entity and redefine the productive capacity which enriches its identity. Brand and Jax (2007: 5) state that the resilience of ecosystems can be increased by improving their capacity to maintain desirable eco-systemic services such as the production of food or crops, purification of water, and aesthetic enjoyment. In response to this, a network of interconnected relationships is established between the new productive industries, the scarred landscape, society, and the industrial heritage (**see Figure 3.4**). By providing the site with new functions, these interconnected relationships would maintain the ability to produce resources which would increase its resilience. This would prevent the collapse of the whole system by increasing its ability to absorb change and stress, allowing it to maintain its functionality despite the fact that some of the new proposed industries may become redundant and lose their purpose (**see Figure 3.5**).



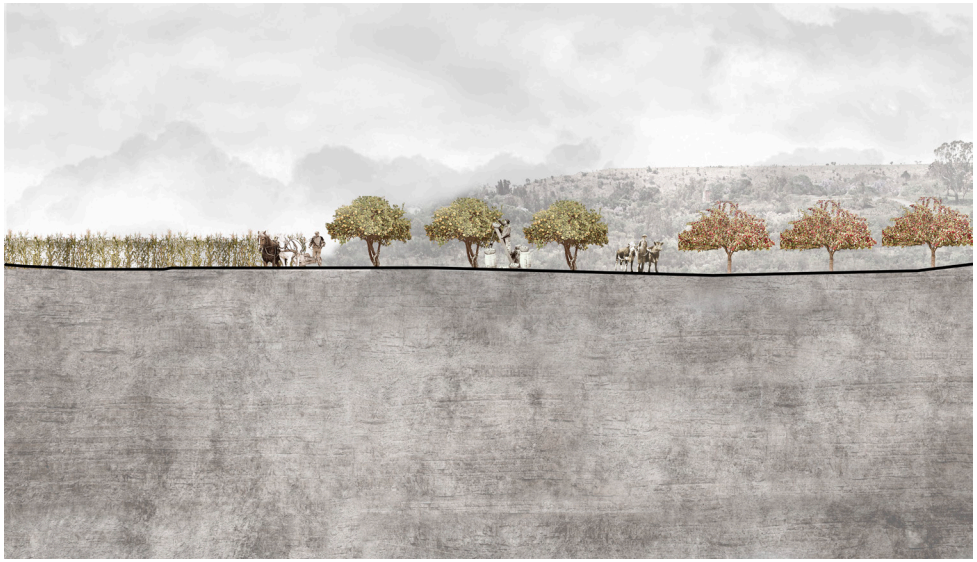
3.4_ New Multi-functional industries before collapse (Author, 2014).



3.5_ New Multi-functional industries after collapse (Author, 2014).

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AGRARIAN SOCIETY:



3.6_ Agrarian society (Author, 2014).

MINING SOCIETY:



3.7_ Mining Society (Author, 2014).

REGENERATIVE DESIGN:

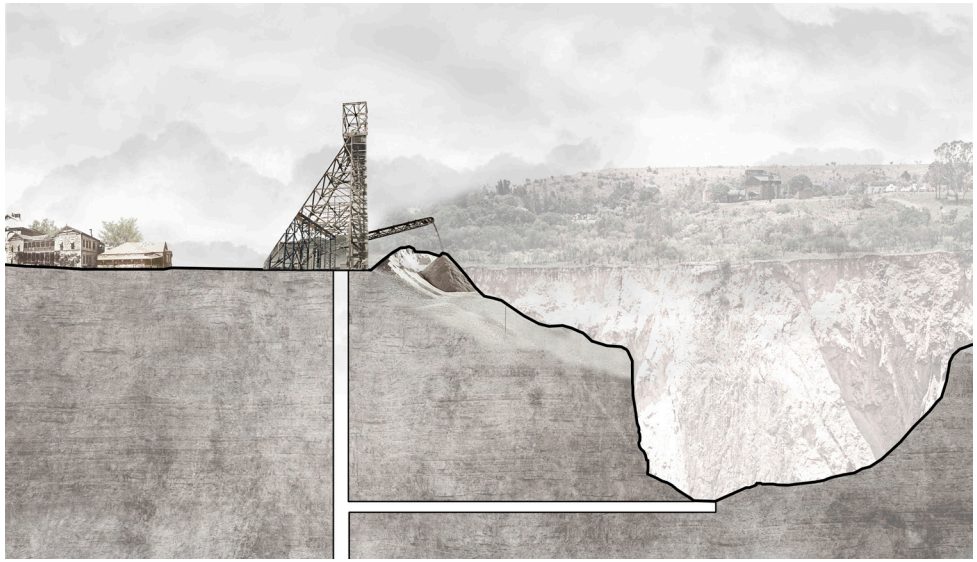
Du Plessis (2013: 37) states that: "Regeneration represents the active, creative principle that transforms and renews a system." Reed (2001: 677) defines regenerative design as "a design process that engages and focuses on the evolution of the whole of the system of which we are part. By engaging all the processes of the place – humans, other biotic systems, earth systems, and the consciousness that connects them – the design process builds the capability of people and the 'more than human' participants to engage in continuous and healthy relationship through co-evolution." The proposed intervention at the mine should therefore establish interconnected relationships between man and the post-industrial landscape, and facilitate the healing of the scarred environment by creating conditions and opportunities for new life to thrive.

STORY OF PLACE:

It is essential to understand the Story of Place embodied within the scarred environment in order to be able to develop an appropriate regenerative response. Mang and Reed (2012: 32) define the Story of Place as a "narrative structure or framework" which "emerges by developing a pattern understanding of how the geological, natural, and human history and culture have interwoven through time to create the unique nature of a place." Mang and Reed (2012: 30) elaborate on the importance of comprehending the Story of Place in that it evokes a spirit of caring and deep understanding of a place. It enables an understanding of how living systems function and how man-made systems can be aligned with these systems to the benefit of all, and it provides a framework for a continuous learning process that enables people to co-evolve with their environment. Reed (2001: 678) makes it apparent that by analyzing historic and present patterns of relationships between man and his environment, a greater understanding of place can be gained. This can inform an appropriate response to how the post-industrial scarred environment can be supported and regenerated through design. The Story of Place of Cullinan is synthesized through a series of diagrams, as shown in **Figures 3.6 to 3.10**.

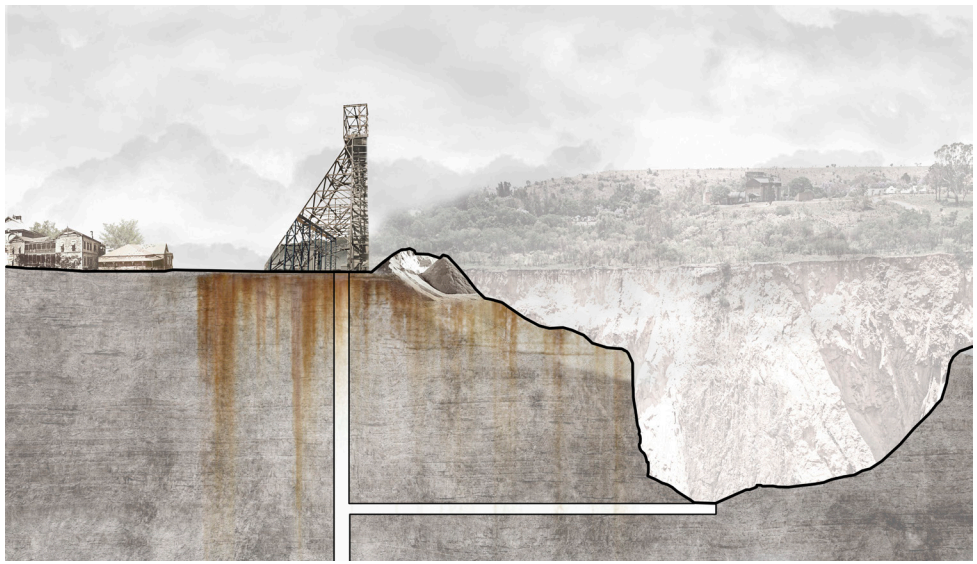
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INDUSTRIAL MINING SOCIETY:

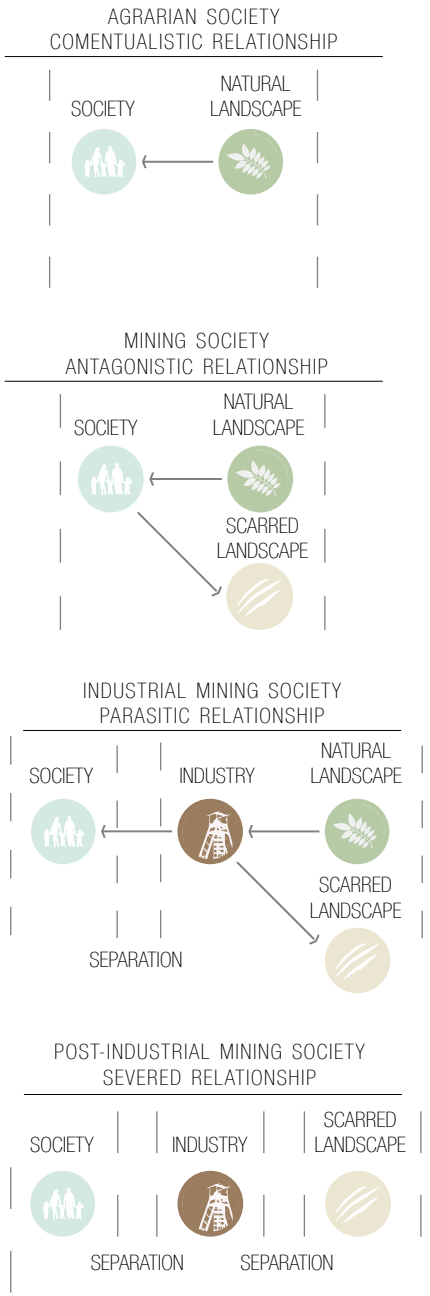


3.8_ Industrial mining society (Author, 2014).

POST- INDUSTRIAL MINING SOCIETY:



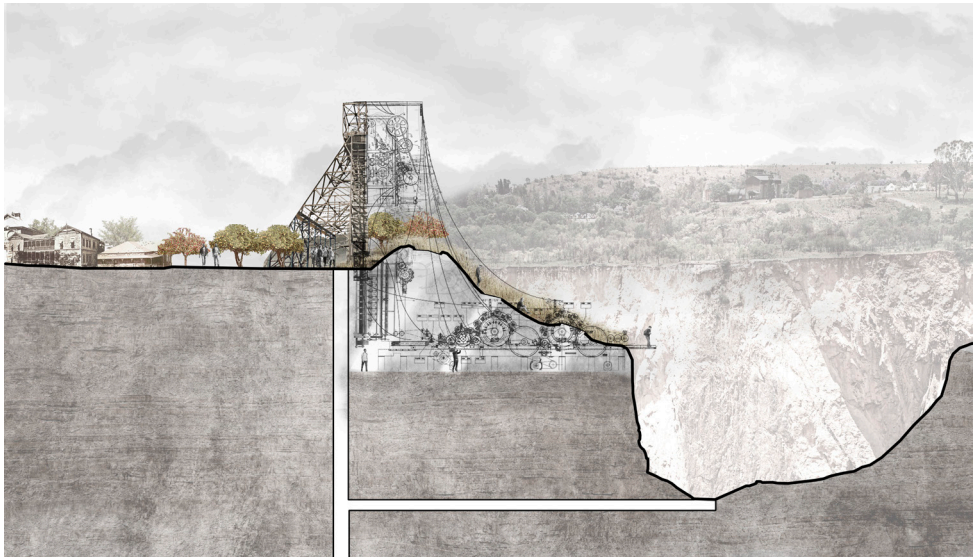
3.9_ Post-industrial mining society (Author, 2014).



3.10_ The changing relationship between society, industry and the landscape. (Author, 2014).

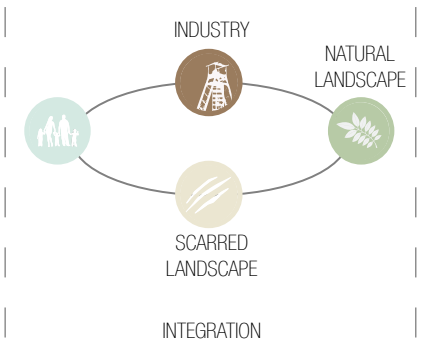
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SOCIAL-ECOLOGICAL INDUSTRIAL REGENERATION:



3.11 _ Social-ecological industrial regeneration (Author, 2014).

CO-EVOLVING MUTUALISTIC RELATIONSHIP



3.12 _ Establishing a new relationship of co-evolving mutualism between industry and the scarred environment (Author, 2014).

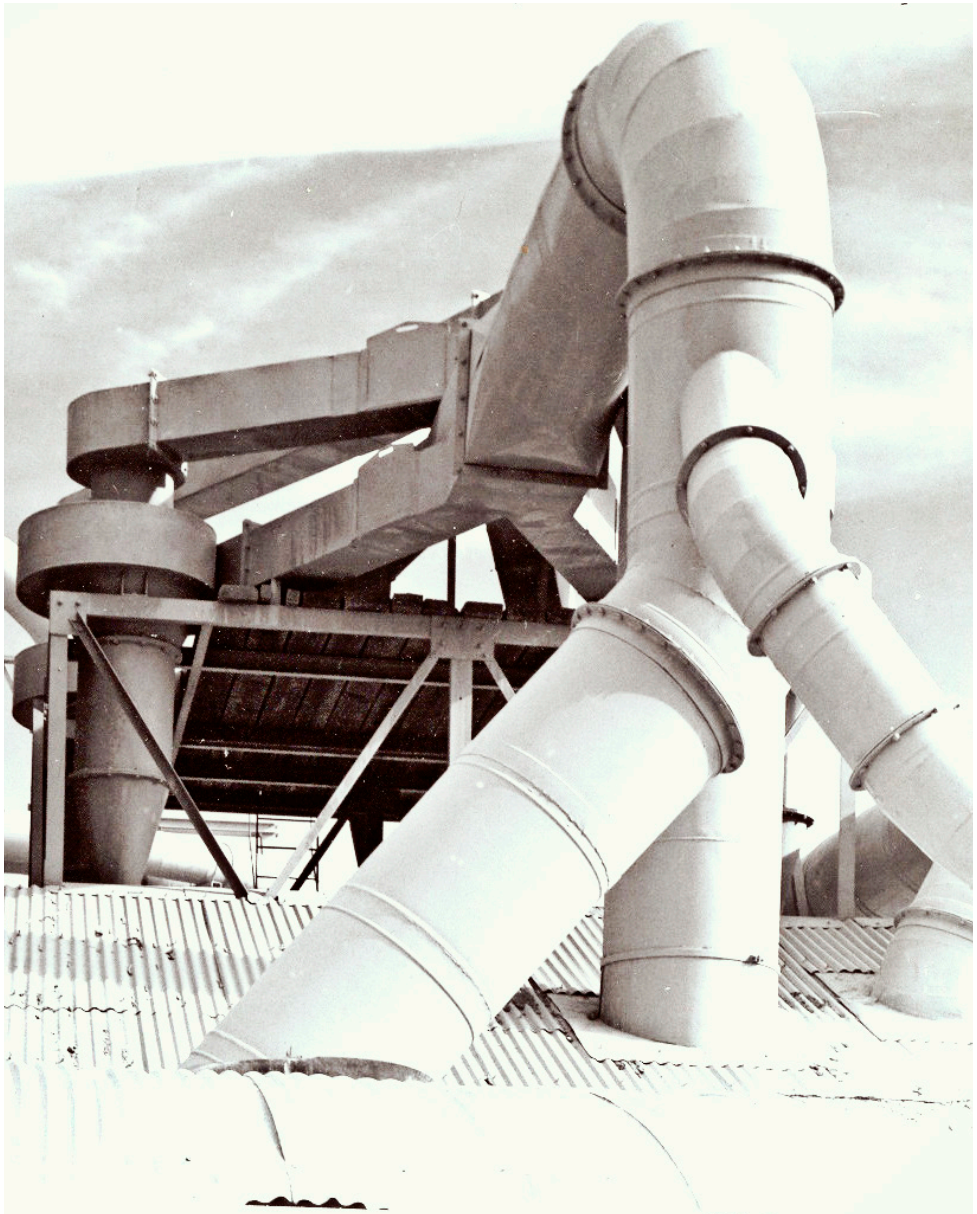
CO-EVOLVING MUTUALISM:

Du Plessis (2013: 38) describes co-evolving mutualism, shown in **Figure 3.12** as: A relationship "in which natural and human systems are integrated to support the mutually beneficial evolution of both systems. It is far more than the restoration of a system, or even improving its performance. Regenerative development is about creating the conditions that allow the system to continue improving and evolving, adapting to an ever-changing environment." The regenerative paradigm emphasizes the fact that new development and interventions should contribute to the capability of natural, cultural and economic systems within the scarred environment in order to grow and evolve the health and viability of these components as shown in **Figure 3.11 and 3.12** (Mang & Reed, 2012: 28). This postulates the question as to how architecture can create an interlinked social–ecological system within the post-industrial scarred environment that builds resilience in contrast to the previous mechanistic system of the mine which created disruption and separation.

FACILITATING POSITIVE CHANGE THROUGH RENEWAL:

According to Du Plessis (2013: 35), it is imperative to comprehend that resilience and regeneration are not opposing concepts, but rather complementary facets of the ecological world view that recognizes the significance of both persistence and change. Du Plessis (2013: 35) further explains that: "Resilience thinking therefore acknowledges the need at times to release potential that can be used to reorganize the system, so that it can adapt to new conditions. Regenerative design or development considers the available potential and flows in the system and how this can be used to bring new life, new function and new form." Before the inherent opportunities and possibilities that lie dormant within the industrial heritage can be identified, its value needs to be understood. The following chapter will serve to foster an understanding of the value of the industrial heritage at Cullinan.

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3.13 _ Dust extraction unit (Lincoln: 2011 edited by author)

DELINEATING THE VALUE OF INDUSTRIAL HERITAGE:

The prospect of the de-industrialization of sites has suddenly drawn substantial attention to overlooked industrial areas. Most people are uncertain as to why these sites should be qualified as heritage. According to Bergeron (2012: 36-37), substantial efforts must be made to preserve the industrial heritage of these sites by means of "intensive effort to help the survival of a collective memory among the post-industrial generations, by making post-industrial sites globally intelligible after their loss of function and by the mobilization of imagination, invention and creativity in view of re-integrating them into daily life, employment and other cultural or public service needs of the inhabitants."

The following section will define the value of the industrial heritage within the Cullinan mine. The Nizhny Tagil and Burra charters will be consulted to develop an appropriate design strategy that informs the framework and architectural response, and supports the intention of questioning the current rehabilitation strategies of the mine. It will do so by providing a new approach to industry that would create new function and meaning. An understanding of the industrial heritage and the scarred landscape creates an awareness of historical relationships between man and his environment, and allows reflection on the past to inform a new future relationship. According to Tempel (2012: 142), the scarred environment created by industry makes us aware of the pollution and destruction of our environment, and that social and economic changes that occurred as a result of industry and technology changed the character and nature of industry. It functions as a physical recollection of our history and development and guides us towards an improved future condition. The value of the industrial heritage therefore needs to be understood and defined to prevent us from destroying the material evidence of our past industrial culture.

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3.14 _ Conveyors from Washing Plant to HMS plant (Lincoln: 2011 edited by author)

For more than three centuries industrialization has been a fundamental component of economic and social change, as it enabled countries or regions to lift themselves out of agrarian dependency by means of providing a new form of prosperity (Cossons 2012: 6). At Cullinan this is apparent in the way that the discovery of diamonds initiated the social and cultural transformation of a society that was predominantly agriculturally inclined, to become a colonial town supported by a mining industry that initiated and sustained its development and growth.

Without this industry, Cullinan would not have existed today and the area would have retained the character of an agrarian society on the threshold between the urban and the rural. According to Cossons (2012: 9): "The industrial heritage is of wider social and cultural significance as part of a record of people's lives and as such provides an important sense of history and identity." Within this new industrial community a novel industrial culture developed, with different patterns and conditions of work replacing the age-old traditions of seasonality and uncertainty that characterized pre-industrial culture in Cullinan.

According to The International Committee for the Conservation of Industrial Heritage (TICCIH) and as stipulated in the Nizhny Tagil Charter (NTCIH) (TICCIH 2003), the material evidence of the profound changes that occurred in the way people made objects and extracted resources – as a result of the industrial revolution – is of universal human value, and therefore the significance of conserving this evidence must be recognized. Industrial heritage is defined by the Nizhny Tagil Charter as "the remains of industrial culture which are of historical, technological, social, architectural or scientific value. These remains consist of buildings and machinery, workshops, factories, mines and sites used for processing and refining as well as places of social activities related to industry." At the Cullinan mine several buildings and structures directly relate to the extraction and processing of diamonds and therefore have heritage value. According to the Nizhny Tagil Charter (TICCIH 2003), the values of the industrial heritage can be defined as the following:

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3.15 _ HMS plant (Lincoln: 2011 edited by author)

SOCIAL VALUE:

According to the NTCIH for the Industrial Heritage (TICCIH 2003), social value relates to being a record of the lives and daily rituals of ordinary men and women and therefore provides an important sense of identity and place. This could exist as intangible heritage in records of industry contained in human memory and customs. People's memories are a unique and irreplaceable resource which should be recorded if they are available.

FUNCTIONAL VALUE:

The NTCIH (TICCIH 2003) explains that the survival of particular processes, site typologies and landscapes adds particular value and therefore needs to be conserved. The Charter further clarifies that the conservation of industrial heritage sites requires a thorough knowledge of the purpose or purposes to which they were put and of the various industrial processes which may have taken place there; therefore functional value refers to the specific functional role that a building, structure or piece of machinery played in the industrial processes which took place on the site, and the value which it embodies as representing a part of that process.

HISTORICAL VALUE:

The NTCIH (TICCIH 2003) states that historical value refers to the evidence of activities, processes and events which had and continue to have profound historical consequences for the site. According to the Burra Charter (1999), historic value encompasses the history of aesthetics, science and society. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of its subsequent treatment.

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3.16 _ Mine workers sorting rock (Lincoln: 2011 edited by author)

TECHNOLOGICAL VALUE:

According to the NTCIH (TICCIH 2003), technological and scientific values are associated with something being a significant example of technological achievement in the history of manufacturing, engineering and construction. The Burra Charter (1999) states that the technological and scientific value of a place will depend on the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.

ARCHITECTURAL VALUE:

The Nizhny Tagil Charter for the Industrial Heritage (TICCIH 2003) defines architectural value as the aesthetic value of something for the quality of its architecture, design or planning. According to the Burra Charter (1999: 12), aesthetic and architectural value includes the characteristic sensory perception of a place relating to its form, scale, color, texture, material of the fabric, and the sounds and smells associated with a specific place and its use. According to the Natural Heritage Resources Act No. 25 of 1999) (South Africa 1999: 28), the existing industrial heritage buildings and structures must be respected and valued for their exemplified and persistent value and the meaning that they represent. In clause 34.1 the Act clearly states that "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority" (South Africa 1999: 28). Within the area of focus at the mine various industrial buildings and structures can be identified that are older than 60 years, with some being older than 80 or 100 years, as will be illustrated in the historical analysis conducted in **Figure 3.17** on the following page. It is therefore imperative to identify the value of these buildings and structures to determine an approach for new development.

STATEMENT OF HERITAGE SIGNIFICANCE:

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ANALYSIS OF HERITAGE VALUE:

WASHING PLANT:

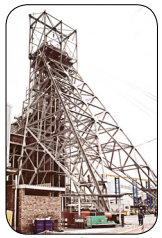


VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting needs to be replaced
Structural steel portal frames in sound condition

NO. 1 HEADGEAR AND SHAFT:



VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE
TECHNOLOGICAL VALUE
ARCHITECTURAL VALUE

AGE:
Older than 60 years

CONDITION:
Very good condition
Structure and connections requires minor maintenance

NO. 3 HEADGEAR AND SHAFT:



VALUE:
FUNCTIONAL VALUE
SOCIAL VALUE
ARCHITECTURAL VALUE

AGE:
Younger than 20 years

CONDITION:
Very good condition
Structure and connections need minor maintenance

WINDER HOUSE BUILDING:



VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting needs to be replaced in some areas
Portal frames and purlins in sound condition

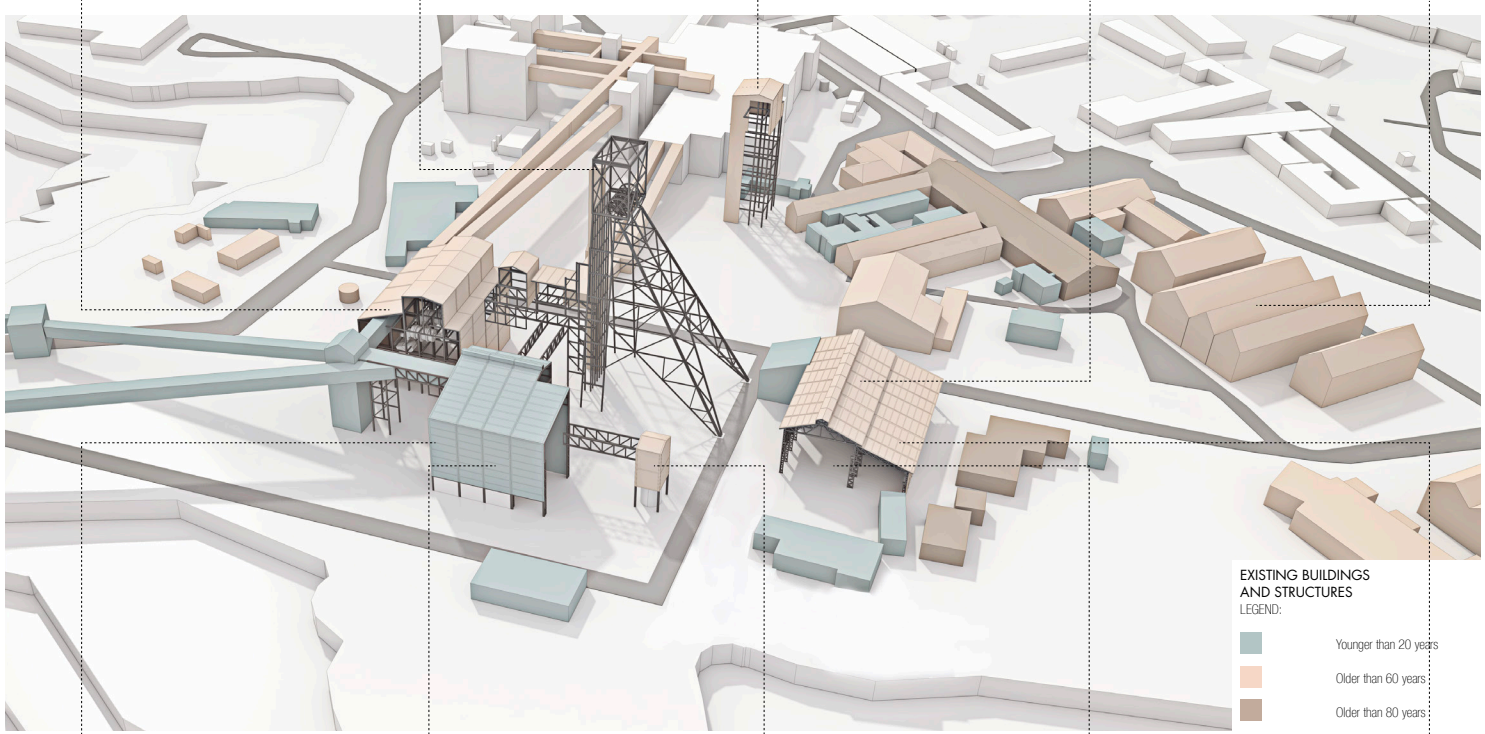
HISTORICAL WAREHOUSES:



VALUE:
HISTORICAL VALUE
SOCIAL VALUE
ARCHITECTURAL VALUE

AGE:
Older than 80 years

CONDITION:
Fair condition, All metal sheeting needs to be re-placed, Portal frames and purlins in fair condition, requires maintenance



CHUTES AND SCRUBBERS:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION OR ADAPTIVE RE-USE

AGE:
Younger than 20 years

CONDITION:
Very good condition
Possibility - adaptive re-used

CRUSHER BUILDING:



VALUE:
FUNCTIONAL VALUE

AGE:
Younger than 20 years

CONDITION:
Good condition
Metal sheeting needs to be replaced in some areas
Structural steel framework and portal frames in sound condition

WATER AND PUMPING TOWER:

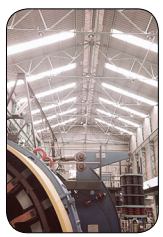


VALUE:
FUNCTIONAL VALUE
HISTORICAL VALUE

AGE:
Older than 60 years

CONDITION:
Good condition
Metal sheeting in good condition
Structural steel framework in sound condition

ORE HOISTING MACHINERY:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION

AGE:
Older than 60 years

CONDITION:
Good condition
Requires some maintenance

M.G. SET MACHINERY ROOM:



VALUE:
FUNCTIONAL VALUE
A SINGLE EXAMPLE NEEDS TO BE CONSERVED BY MEANS OF PRESERVATION

AGE:
Older than 60 years

CONDITION:
Good condition
Requires minor maintenance

3.17 _ Conveyors from Washing Plant to HMS plant (Lincoln: 2011 edited by author)

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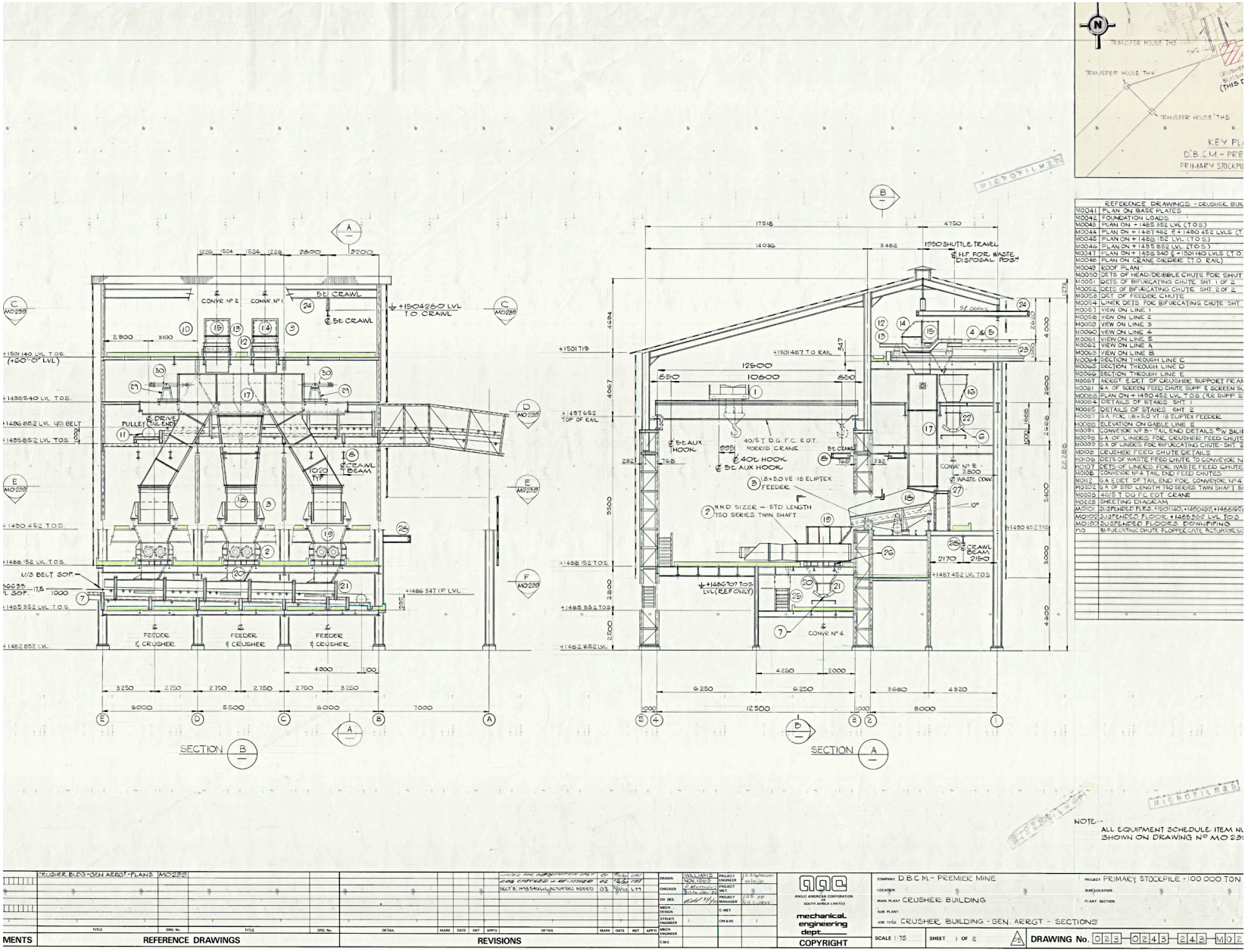
3.18 _ Showing the flow of material to and from the Crusher building (Author, 2014)

Current rehabilitation strategies for the mine only advocate the preservation of certain historical buildings, structures and elements, including the open pit, the No. 1 Headgear and the treatment facility, as relics of diamond mining to act as draw-cards for tourists. The remaining buildings, namely the crusher building, the washing plant, the No. 3 Shaft and Headgear, the water pumping tower and the winder house building will be dismantled and reconstructed. All of these buildings are, however, intricately connected to the diamond mining process, and if they were removed one would be unable to clearly understand the historical industrial process and its relationship with its environment. These buildings therefore act as important local visual remnants of the mining industry and, according to the NTCIH, embody historical value by being "the physical evidence of activities, processes and events which had and continue to have profound consequences." However, the value of the industrial heritage at Cullinan is not merely contained in the physical manifestation and aesthetic representation of the industrial buildings and structures. Although these buildings function as mnemonic devices of mining and industry, their function as the heart or catalytic core which produced resources in order to sustain the town and community is what gives meaning to the heritage and contributes to its unique character and sense of place. Therefore, by re-establishing their function through new productive industries, the meaning attached to the functional value of the industrial heritage can be reclaimed and enriched.

PRESERVATION, ADAPTIVE RE-USE AND CONSERVATION:

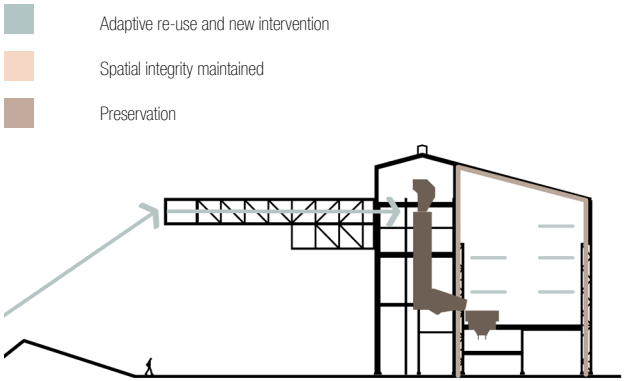
The Burra Charter defines restoration as the return of an existing building to a known earlier state by removing deterioration and reconstructing existing components without the introduction of new material (Burra Charter 1999: 2). According to Cossons (2012: 9), if the mere preservation of redundant industrial sites were advocated based on arguments motivated by traditional heritage values, it would mean that the economic and social conditions of the surrounding community, which may be afflicted by economic collapse and high levels of unemployment due to the decommissioning of the industry, are ignored.

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3.19 _ Drawing of Crusher building. (Lincoln: 2011 edited by author)

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3.20 _ Showing the flow of material to and from the Crusher building (Author, 2014).



3.21 _ Crusher building and connection to water pumping tower (Author, 2014).



3.22 _ Crusher building and conveyor belt connection with landscape (Author, 2014).

Therefore, current rehabilitation strategies at the mine are unsustainable in that they would fail to provide the industrial heritage with a new purpose able to increase its resilience. Thus, to address the industrial heritage at the mine, an alternative approach is required which would be able to provide the buildings and structures with a new purpose. The NTCIH (TICCIH 2003: 5) states that: "Sympathetic adaption and re-use may be a cost-effective way of ensuring the survival of industrial buildings" (TICCIH 2003: 4). According to the Burra Charter (1999: 2), adaptive re-use can be defined as modifying a place to suit the existing use or a proposed use. The Burra Charter (1999: 6) also recognizes that all places and their characteristics change over time at different rates; therefore the sympathetic adaptive re-use of the existing buildings at the mine is motivated in that it would give them new purpose which would provide a greater incentive for their conservation. **Figure 3.20** shows an interpretation of the heritage value discussed earlier and its implications for an architectural response. According to the NTCIH (TICCIH 2003: 5): "Every effort should be made to ensure the consultation and participation of local communities in the protection and conservation of their local industrial heritage." In response to this, the proposed architecture should strive to establish a new public interface within the industrial heritage.

THE CRUSHER BUILDING:

The crusher building consists of portal frame structures laid out according to an irregular grid which responds to the functional requirements of each space (see **Figure 3.19**). This grid divides the building into four distinct segments where different spatial conditions prevail. The feeder and crusher machine is divided into 3 sections which exist in segments ED, DC and CB within the building. This machine draws kimberlite ore from the reserve kimberlite tailings located west of the site by means of a conveyor belt system. It is then crushed and refined, after which it is transported to the washing plant for further processing (see **Figure 3.21**).

The NTCIH (TICCIH 2003: 5) states that: "The value and authenticity of an industrial site may be greatly reduced if machinery or components are removed, or if subsidiary elements which form part of a whole site are destroyed." In response to this it is proposed that the section of the machinery located in segments ED and DC are preserved and exhibited, as these sections have a more direct connection to the conveyor system. These machines will thus retain an awareness of the historical function of the crusher building and make the relationship it had with the scarred landscape through the conveyor system apparent. The chutes of the feeder and crusher machine located in segment CB will be adaptively re-used to offload Vetiver grass, harvested on the reserved kimberlite tailings and conveyed by the existing conveyor system to the crusher building. This would establish a new relationship with the scarred environment through adaptive re-use. The NTCIH for the Industrial Heritage (TICCIH 2003: 5) states that: "The adaptation of an industrial site to a new use to ensure its conservation is usually acceptable except in the case of sites of special historical significance. New uses should respect the significant material and maintain original patterns of circulation and activity, and should be compatible as much as possible with the original or principal use. An area that interprets the former use is recommended." The double-volume space within segments CB and BA will be adaptively re-used as a hydroponic growth space for aromatic plants by means of inserting new lightweight steel mezzanine levels. These would retain the spatial integrity of the space in that it would still be read and experienced as a double volume (see **Figure 3.22**).

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3.23 _ The scarred landscape (Lincoln: 2011 edited by author)

The steel mezzanine levels will completely distinguish themselves from the existing portal frame structure by sitting within it, without directly being attached to its sides. This will be achieved by either suspending these levels from the portal frame structure, or by having them supported by a new structural framework which sits within the existing building's envelope. The steel sheeting in these segments (CB and BA) will be replaced with polycarbonate sheeting to allow sufficient daylighting, as required by the hydroponic growth spaces. Segments ED and DC are preserved as areas which interpret the building's former use. The NTCIH (TICCIH 2003: 5) makes it clear that "continuing to adapt and use industrial buildings avoids wasting energy and contributes to sustainable development. Industrial heritage can have an important role in the economic regeneration of decayed or declining areas. The continuity that re-use implies may provide psychological stability for communities facing the sudden end of a long-standing source of employment." Spaces with specific functional requirements can be created by means of a new framework that attaches itself to the existing portal frames, as long as the connection between the old and the new is clearly expressed in order to allow for differentiation between them. The new additions should also distinguish themselves from the typology of the existing crusher building by reading as separate elements. This could be achieved by lifting new additions off the ground so that they can distinguish themselves from the outline or form of the existing building.

THE SCARRED LANDSCAPE:

Landscapes give us an informative impression about the economic and technical development of a particular society; they are, in fact, more informative as they give us a comprehensive, detailed and precise account of the state of the environment in a far better way than any museum could possibly do – Walter Benjamin, Passagenwerk (Cited in Tempel 2012: 142).

The exploitation of the environment to access resources leaves behind specific evidence on the landscape which cannot be ignored. Industry often inflicts irreparable, long-term environmental damage to the landscape and creates extensive social problems as a result of this exploitation (Tempel 2012: 143). The landscape at the Cullinan Diamond Mine has been significantly altered, carved, excavated and disrupted over time to extract resources. This destructive extraction has created a scarred landscape as a testament to an exploitative relationship between industry and the environment and embodies significant heritage value. Stuart (2012: 54) makes a noteworthy statement in that: "Industry has had a powerful, although often subtle impact on our environment over time. The identification and analysis of industrial landscapes is an important tool for understanding how industry worked, created and shaped our environment and in identifying the heritage values that flow from that activity." Therefore, by understanding the scarred landscape and how it was created, one becomes aware of how the diamond mine at Cullinan functioned in relation to the natural environment and what relationship there existed between industry and nature.

Tempel (2012: 143) states that: "In most cases when an industrial plant is closed down or a mine is abandoned, the remediation of environmental contamination, the cleaning up of a site so that no traces are left, takes priority over heritage preservation. This way of thinking is hasty and indefensible. Industrial heritage is an essential part of human development and of history.

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3.24_ (Lincoln, 2001, edited by author)



3.25_ (Lincoln, 2001, edited by author)

It can tell us a great deal about economic structures as well as about the working conditions – what Marxist theory calls 'relations of production' – of its time." This makes it clear that the current rehabilitation strategy of the mine of returning the scarred landscape back to a constructed natural state, which will then become part of the Premier Game Park, will cause a major loss of heritage value, authenticity and sense of place. According to Tempel (2012: 143): "The landscapes that have evolved through industrialization are now themselves endangered through de-industrialisation, yet they are worth protecting. When de-industrialisation is seen as a social loss for a particular region, then preservation becomes important." The authenticity and meaning of the scarred landscape at Cullinan is therefore placed under significant threat by the decommissioning of the mine and the rehabilitation strategies that mine authorities are currently proposing. A more appropriate response would be to achieve a sense of balance within the scarred landscape between the production of raw materials, agricultural practices, ecological remediation, and the conservation of its unique character, and providing for the requirements of tourism and a leisure-oriented society within the post- industrial environment (Tempel 2012: 147).

An alternative solution is therefore proposed whereby the scarred landscape is selectively planted with Vetiver grass, as is currently already propagated in certain regions. This Vetiver grass will be planted in such a way so as to recognize the fact that the scarred landscape is a manufactured site.

The scarred landscape can then be remediated to prevent soil erosion and water pollution without losing its integrity and identity, while simultaneously providing an economic incentive for its remediation.

Tempel (2012: 146) states that "…an honest handling of the landscape which has been transformed industrially, the conscious preservation and demonstration of traces of industrial activity as an integral part of a post-industrial landscape, are all factors which have been realized recently." The open-pit excavation is what gives Cullinan its unique character, identity and sense of place. It is the disruption that most clearly represents the impact of man and industry on the environment.

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3.26 _ Cone- shaped waste rock dumps in Cullinan (Lincoln: 2011 edited by author)



3.27 _ Vetiver grass currently used to re-mediate the scarred landscape
(Author: 2014)

Additionally, it signifies man's technological progression and development. It is the ultimate physical manifestation of industrial exploitation.

In light of this, an experiential promenade is proposed that would re-establish a connection between the industrial heritage, the scarred landscape and the open-pit excavation. Along this route a series of experiential and sensory spaces are created which would allow the public to engage with the post-industrial scarred environment. In conclusion, Tempel (2012: 148) illuminates the fact that the preservation and development of industrial scarred landscapes as a sedimented history should be of paramount importance, due to the fact that it can be understood as a conflict history between man and nature.

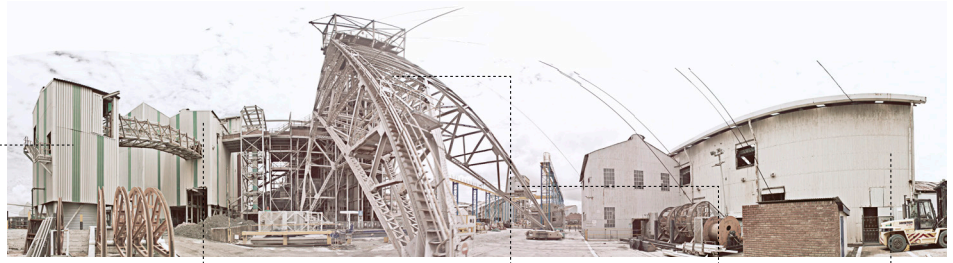
Figure 3.28 on the following page shows an interpretation and implementation of the identified heritage value.

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INTERPRETATION AND IMPLEMENTATION OF HERITAGE VALUE:



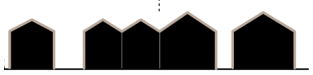


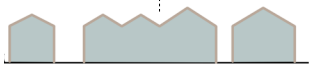






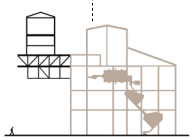
HISTORICAL WAREHOUSES:

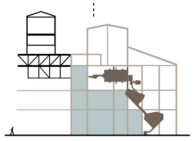




EXTERNAL ENVELOPE CONSERVED, INTERNALLY RECONFIGURED ADAPTIVELY RE-USED as conference facilities and visitors accommodation

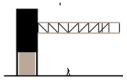
WASHING PLANT:

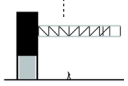




STRUCTURAL FRAMEWORK AND PORTAL FRAMES CONSERVED, example of historical machinery kept intact and exhibited, SECTIONS OF SHEETING REPLACED WITH TRANSPARENT POLYCARBONATE SHEETING - allows for more natural daylight penetration, adaptively re-used as a mill and bakery

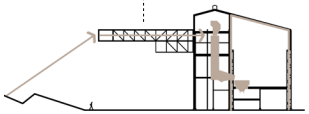
WATER AND PUMPING TOWER:

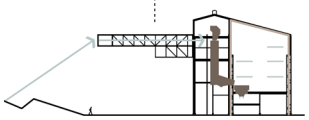




ENVELOPE AND STRUCTURE KEPT IN TACT,FUNCTION IS MAINTAINED BUT RECONFIGURED TO PROVIDE A WATER SUPPLY TO THE NEW PRODUCTIVE INDUSTRY.

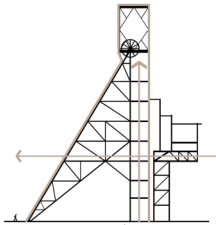
CRUSHER BUILDING:

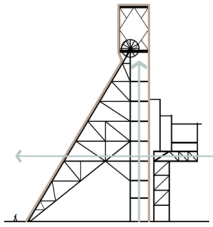




STRUCTURAL FRAMEWORK AND PORTAL FRAMES CONSERVED, HISTORICAL MACHINERY ADAPTIVELY RE-USED as transportation chutes for harvested Vetiver grass crops, SHEETING REPLACED WITH TRANSPARENT POLYCARBONATE SHEETING to accommodate proposed hydrophonic aromatic plant greenhouse, conveyor belt system adaptively re-used to transport harvested Vetiver grass crops

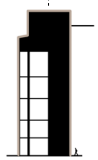
NO. 1 HEADGEAR AND SHAFT:

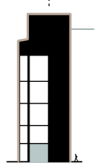




COMPLETE STRUCTURE AND ALL MACHINERY CONSERVED, exists as a landmark, beacon or orientation point within cullinan as a whole, REMOVABLE LIGHTWEIGHT PUBLIC VERTICAL CIRCULATION STAIRCASE and walkways proposed as main vertical public circulation point.

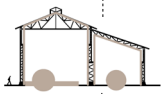
NO. 3 HEADGEAR AND SHAFT:

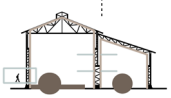




COMPLETE STRUCTURE AND ENVELOPE CONSERVED, exists as a arrival point at the mine, adaptively re-used as a information center and threshold or starting point for underground mining tours

WINDER HOUSE BUILDING:





STRUCTURAL FRAMEWORK AND PORTAL FRAMES CONSERVED, example of historical machinery kept in tact and exhibited, SECTIONS OF SHEETING REPLACED WITH TRANSPARENT POLYCARBONATE SHEETING - in order to house the proposed hydrophonic aromatic plant greenhouse, new public retail penetrates the western facade at ground level

3.28 _ Implementation and interpretation of heritage value

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3.29 _ Existing water pumping tower at Cullinan (Author: 2014)

IDENTIFYING EXISTING OPPORTUNITIES AND POSSIBILITIES WITHIN THE INDUSTRIAL HERITAGE:

By applying the principles of resilience and regenerative design, opportunities and possibilities which currently exist on the industrial heritage site can be identified:

- Vetiver grass is currently extensively being used to rehabilitate and remediate the scarred landscape of the mine at Cullinan.
- The existing buildings at the mine can be adaptively re-used.
- The water pumping tower and other infrastructure located on the site are still in good working condition and provide significant potential for reutilization.
- The site investigated in this dissertation previously functioned as a waste-rock dumping site, where waste rock hoisted from the mine was separated from the kimberlitic ore and dumped by an elevated conveyor to form a cone shaped heap (see **Figure 3.27**). This waste rock heap was then flattened to be level with the surroundings.

EVOLUTIONARY, REGENERATIVE RESILIENCE:

The interconnected relationship between resilience and regenerative design "introduces a third level of resilience, which adapts by reorganizing existing processes, structures and elements to renew and transform the system and create new ways of doing and new relationships that allow the emergence of new development pathways" (Du Plessis 2013: 39).

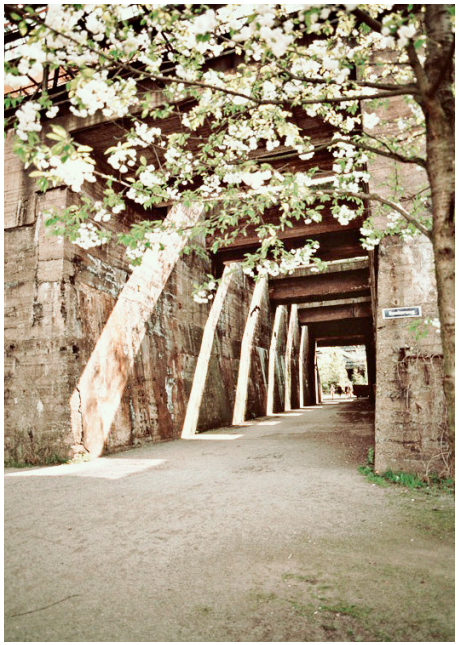
By applying the principle of regenerative design, the potential identified through resilience thinking can be used to re-organize existing processes, structures and elements. This can transform declining systems, create new approaches and establish new relationships that facilitate regeneration (Du Plessis 2013: 37). Regenerative design aims to use existing natural and social potential in a system to reveal hidden possibilities and opportunities, and establishes a relationship of co-evolving mutualism between the man-made and the natural (Du Plessis 2013: 38).

- Further research into Vetiver grass led to an unexpected discovery, namely that its roots contain an essential oil that can be extracted to generate revenue. This provides economic incentive for the use of Vetiver grass for the rehabilitation and remediation of the landscape, and facilitates the transformation of a scarred, manufactured landscape into a productive one.
- The existing buildings have significant volume and, by replacing certain sections of sheeting with transparent polycarbonate sheeting, can therefore be adaptively re-used as production or growth spaces that supply raw material to the new productive industries.
- The water pumping tower can be adaptively re-used to supply fresh water to the new productive industry.
- The waste-rock dump on the site can be excavated to create new submerged spaces that accommodate specific programmatic requirements or spatial experiences. This would provide an effective thermal mass able to regulate the internal micro-climate, and would also allow for a diversity of spatial experiences.

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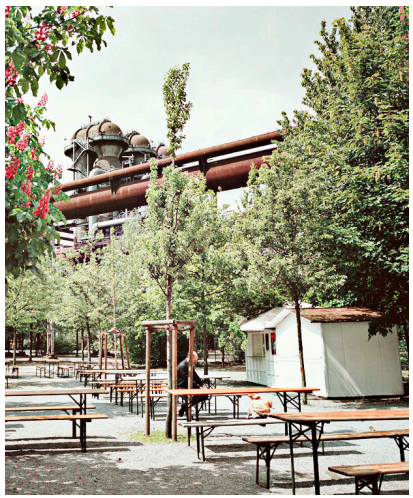
3.30 _ The existing blast furnaces were retained as symbols or landmarks on the site contributing to retaining its unique atmosphere (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.32 _ Industrial infrastructure are retained to establish a series of threshold between the contained spaces on the site. (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.31 _Integration of the natural landscape with the existing industrial infrastructure (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.33 _ Recreational public spaces (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).

HERITAGE APPROACH CASE STUDY/ EMSHER LANDSCAPE PARK (1999)

Architects: International Building Exhibition Emsher Park (IBA)
Location: In the north of Duisburg between the urban districts of Hamborn and Meiderich
Project Area: 230-hectare park

The Emsher landscape park in the Ruhr valley of Duisburg Nord, Germany involved the rehabilitation of a 230-hectare post-industrial site previously occupied by coal, iron and steel industries. An investigation was conducted of this regenerative development to establish how the post-industrial scarred environment can be successfully regenerated, remediated and developed without losing its unique ambiance or sense of place. This approach to the industrial heritage will serve as a precedent for how the decommissioned industrial heritage within the Cullinan mine can be re-used. Through adaptive re-use new social, ecological and economic opportunities are created while regenerating the scarred landscape without compromising its heritage value and meaning.

The intentions of the project was to "...integrate, shape, develop, and interlink the existing patterns that were formed by its previous industrial use..." to restore the fundamental ecological base of the site (Latz, 2011:150). The first step in regeneration was the removal and bio-remediation of toxic heavy metal and hydrocarbon waste in order to decontaminate the site. Extensive decontamination is unnecessary at the Cullinan mine as the diamond extraction process does not require the use of chemicals like other mining industries and can be washed out of the kimberlite ore using water.

The post-industrial site at the Emsher landscape park was made publically accessible by means of a network of promenades, footbridges and walkways at different levels which connect the various spaces. Most of the industrial buildings and structures, such as the existing blast furnaces shown in **Figure 3.30**, were retained as symbols or landmarks of industry and effectively integrated into the new development to maintain the unique industrial character or atmosphere of the site.

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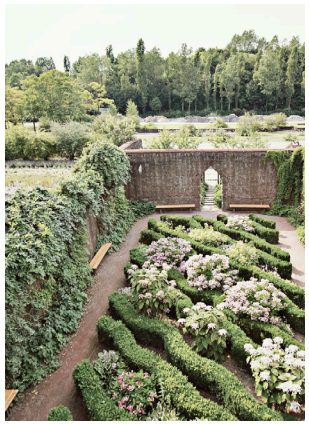
3.34 _ The ore bunkers being re-used as climbing walls (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



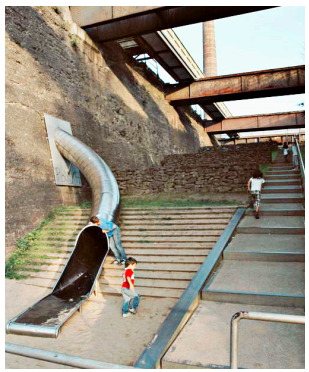
3.35 _ Existing infrastructure re-used as a slide (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.36 _ A skate-park with the existing industry (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.37 _ (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.38 _ (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).



3.39 _ (Acre landscape studio <http://acrestudio.tumblr.com/>, edited by author).

A similar approach will be employed at the Cullinan mine by conserving prominent structures such as the No.1 shaft and headgear as a landmark or orientation point within Cullinan. This structure can also function as a view point over the site while being utilized as the primary means of vertical circulation providing access to the surrounding buildings on different levels.

Certain buildings such as the electrical workshop of the blast furnace at Emsher are adaptively re-used as a training center, exhibition space and a concert hall (Latz, 2011:151). This approach of adaptive re-use will be employed at the mine in Cullinan to inform the re-use of the existing buildings to house a variety of productive and social functions, such as hydroponic greenhouses, various retail spaces, market spaces and an eatery.

The former ore bunkers were either adaptively re-used as climbing walls shown in **Figure 3.34** or converted into enclosed gardens (see **Figure 3.37**) creating new social programs within the post-industrial environment. The existing industrial infrastructure, such as the service pipes shown in **Figure 3.35 and 3.38,** was converted into a slide for children. Certain spaces within the industry are developed as playhouses or playgrounds with sandboxes and climbing nets while other areas where utilized as a skate-park as shown in **Figure 3.36.** A diving club (shown in **Figure 3.39)** has established itself on the site by utilizing the redundant ore bunkers, that have filled with groundwater, as underground lakes for diving (Latz, 2011:151).

Furthermore, a series of parks each with its own unique character was developed on different levels within the existing industry. These parks are connected by a series of ramps, stairs and terraces. The historical wastewater ditch was cleaned and decontaminated and is currently being used as a new freshwater channel while the cooling basins are used as water retention ponds which establishes a new biotope on the site. (Latz, 2011:154-155)

From the case study conducted various principles and practical methods were established as a means of regenerating the post-industrial scarred environment by creating new public spaces and social opportunities while enhancing its sense of place.

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3.40 _ The annual mampoer festival at the Willem Rinsloo Agricultural museum (<https://www.facebook.com/mampoersa>, edited by author: 2014).



3.41 _ The annual mampoer festival at the Willem Rinsloo Agricultural museum (<https://www.facebook.com/mampoersa>, edited by author: 2014).mampoersa>, edited by author: 2014).

A REGENERATIVE APPROACH TO DESIGN AS A PROGRAMMATIC INFORMANT:

Mang and Reed (2012: 26) believe that it is significant to organize human activities in such a way that they feed into and are continuously fed by the living environment within which they occur. Reed (2001: 677) makes it clear that: "Regeneration of the health of the humans and local earth systems is an interactive process – each supports the other in a mutually beneficial way." The Vetiver grass at the mine in Cullinan would not only remediate and rehabilitate the scarred landscape, but is also given value by proposing architecture that enables its extraction as a valuable essential oil crop. Mang and Reed (2012: 26) state that: "… regenerative development and design means the reconnection of human aspirations and activities with the evolution of natural systems – essentially co-evolution. It means shifting human communities and economic activities back into alignment with life processes and thus integrating ecology and economy." Therefore, if the architecture can facilitate the extraction of essential oils, it becomes regenerative in that it facilitates a mutualistic relationship between man and the scarred landscape by systematically restoring the neglected ecology, while at the same time providing the local community with a new source of income. Vetiver grass is a non-invasive pioneer species in that it is able to re-establish a favourable habitat for endemic plant species. This would enable the environment to change over time and increase its resilience. As entropy and decay will ultimately consume all man-made structures, the endemic natural environment will be provided with the opportunity to eventually re-establish itself as a natural environment following the decay of the post-industrial remnants.

By reconnecting a place with its heritage and the historical rituals that took place within the area, a shift from sustainable design and rehabilitation to restorative and regenerative design can be accomplished (Reed 2001: 677). As established in previous chapters, Cullinan is a town in a rural milieu with an important heritage of agriculture and distilling. This is apparent in the fact that the Willem Prinsloo Agricultural Museum is located in close proximity to Cullinan and that, every year, a mampoer festival is held at the museum. Therefore, a reconnection with place can be achieved by means of an architectural programme that embraces this significant heritage of agriculture and distilling, and reinterprets it as a place for the processing of agricultural crops to produce alcoholic beverages,. This program can then initiate public awareness of the significant historical rituals associated with agriculture and heritage which took place in Cullinan. The architecture can become regenerative in that it simultaneously restores the scarred natural environment while enriching its sense of place.

RE-ESTABLISHING A SENSE OF PLACE THROUGH REGENERATIVE ARCHITECTURE THAT ELICITS EXPERIENCE:

According to Mang and Reed (2012: 35): "One of the most powerful effects of the regenerative development process is that in 'rediscovering' their place, people rediscover what they care about and share in common. The resultant sense of shared identity transcends artificial boundaries and is an important force in creating the caring and connection necessary to make the changes required for a sustainable future." By understanding how the scarred environment came into being and how it functioned, the foundations can be established for reawakening the connection people previously experienced with it. The decommissioning of the mine and the proposed rehabilitation strategy by the mine authorities threatens its unique character, identity and sense of place. This decommissioning will erase the qualities that create a sense of belonging for local inhabitants, and will separate the industrial heritage from the public realm by making

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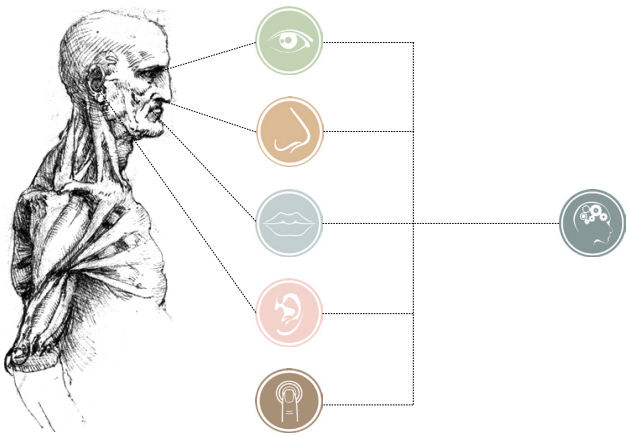
it inaccessible. The post-industrial scarred environment will thus become a redundant, purposeless wasteland, meaningless and alienated from society. The place-making craft of architecture, in a specific context, embodies physical and meta-physical elements of place and determines and defines its boundaries. Architecture is therefore what connects man with his environment (Norberg-Schulz 1988: 181).

Du Plessis (2013: 37) states that we reduce resilience when we reduce diversity, making systems unable to grow and vulnerable to disruptions. This is especially applicable when considering the limited and restricted experiential and sensory environments that the current approach to industry creates. Within the mine at Cullinan structures and spaces exist which elicit a sublime experience. This type of experience is often induced by industrial environments due to their monumental scale, structural expression, tectonic envelopes and multi-level functionality. The nature of this experience, however, is often homogeneous or one-dimensional, and mostly exists as an unanticipated by-product of a typology that is solely informed by function and processes.

According to Pallasmaa (2012: 28-37), meaning and understanding can be attained through architecture when it embodies a multi-sensory experience of place. This meaning becomes apparent through the interaction with space in the present and the resultant impact it has on man. Architecture is able to embody meaning when it is experienced and when all of our senses are engaged in its inhabitation. Pallasmaa (2012: 30) states that: "Every touching experience of architecture is multi-sensory. Qualities of matter, space and scale are measured equally by eye, ear, nose, skin, tongue, skeleton and muscle. Architecture involves seven realms of sensory experience which interact and infuse each other." The echo of a space, its ambiance and temperature, the textures of its planes, the scent drifting through it and the way it augments the sensation of taste is what shapes the emotions of its users. By creating spaces that stimulate powerful sensory and experiential perceptions, an enhanced connection and identification with place can be established. Echoes allow for self-actualization within space, while silence discloses the absence of activity or motion. Hidden recollections can be accessed by means of association and memory trough the interrelated perception of sight and touch.

The major distinction between touch and sight lies in the proximity of its perception. Touch involves physical participation, while sight implies a separation from what is being viewed.

Despite the fact that architecture does not directly address taste, sensory impressions and relations with smells often kindle the perception of taste. Plasma adds to the traditional sensory palette of the five senses by including the three-dimensional realm of the body in space and its ergonomic relationship to buildings and objects. The dimensional dialogue between man and his spatial environment becomes a sense in itself in the way it invites, guides or rejects. The subliminal response of the human body to space that has been molded and crafted resembles a theatrical performance in that man acts out the intentions of the architect as a script. As sensory and spatial experiences define our existence in space, the spatial palette of the architect transcends the tangible into perceptual phenomena. The quality of space within architecture can thus be personified by the experience it orchestrates. By utilizing space to choreograph emotive experiences through the scarred environment, meaning can be conveyed that creates a greater connection to its sense of place.



3.42 _ Multi-sensory space facilitates the formation of new memories and meaning (Author, 2014)

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04

CHAPTER 04 / REINVENTING THE CATALYTIC CORE _ Proposed framework



4.1_ (Lincoln, 2001, ed[illegible])

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URBAN FRAMEWORK / 004

DINOKENG DEVELOPMENT FRAMEWORK /

Cullinan, with the township Refilwe, was established as a direct result of the opening of the original mine and have grown to become a regional service center. Cullinan and Rayton are the main service centers within the rural area of Nokeng tsa Taemane, and are the most important urban nodes in the municipal area. The area around Rayton, Cullinan & Refilwe is described as a mining and urban clustering area. A significant heritage of agriculture exists here, as is evident in the close proximity of the Willem Prinsloo Agricultural Museum and the historical agricultural practices on the Elandsfontein farm. Cullinan currently forms part of this agricultural hub. The town of Cullinan represents one of the strongest tourism nodes in the Dinokeng area and the region as a whole. Tourism and recreation in Dinokeng therefore need to optimize and harness the existing image and further potential of Cullinan as part of the foundations of the local industry. In recent years, however, Cullinan has become increasingly attractive as a dormitory town in support of Rayton and the City of Tshwane. The result is a rapid urbanization rate, with associated non-tourism related functions and services such as shopping centers. Transformation of the rural and historic nature of the town risks damaging the sense of place that is associated with the mine and its related tourism functions, whilst traffic congestion and general infrastructure overload detracts from the visitor's experience. It is therefore necessary to consider the future of Cullinan in the bigger context, namely its location within the broader Dinokeng tourism project, as well as its imminent incorporation with the City of Tshwane municipal area.

The town has intrinsic tourism value, but requires further development of its tourism resources, especially in terms of accommodation, access to information and integrated transportation planning. The stations at Rayton and Cullinan are not optimally utilized. In the broader Dinokeng context, however, cultural and natural resources must be conserved and sustainably utilized for the greater good of the area. Tourism-focused development, associated with diamond mining, Victorian history and rural living, is therefore the priority for Cullinan. The Dinokeng Integrated Tourism Development Framework (DITDF) states that facilities and attractions that will add value and offer opportunities for private sector initiatives are:

- A Victorian theatre (possibly along the lines of the Barnyard Theaters which are currently popular)
- Tourist transport within the town (horse carts, coaches, bicycles like penny farthings, a narrow-gage mine railway, walking routes)
- A picnic area with bandstand
- A park area for outdoor exhibitions (the Artists in the Park concept)
- A restaurant serving traditional African meals
- A range of additional visitor accommodation units

The vision for this framework, along with the proposed initiatives, is shown in **Figure 4.2.**

CRITIQUE AND PROPOSED IMPROVEMENTS AND ALTERNATIVES

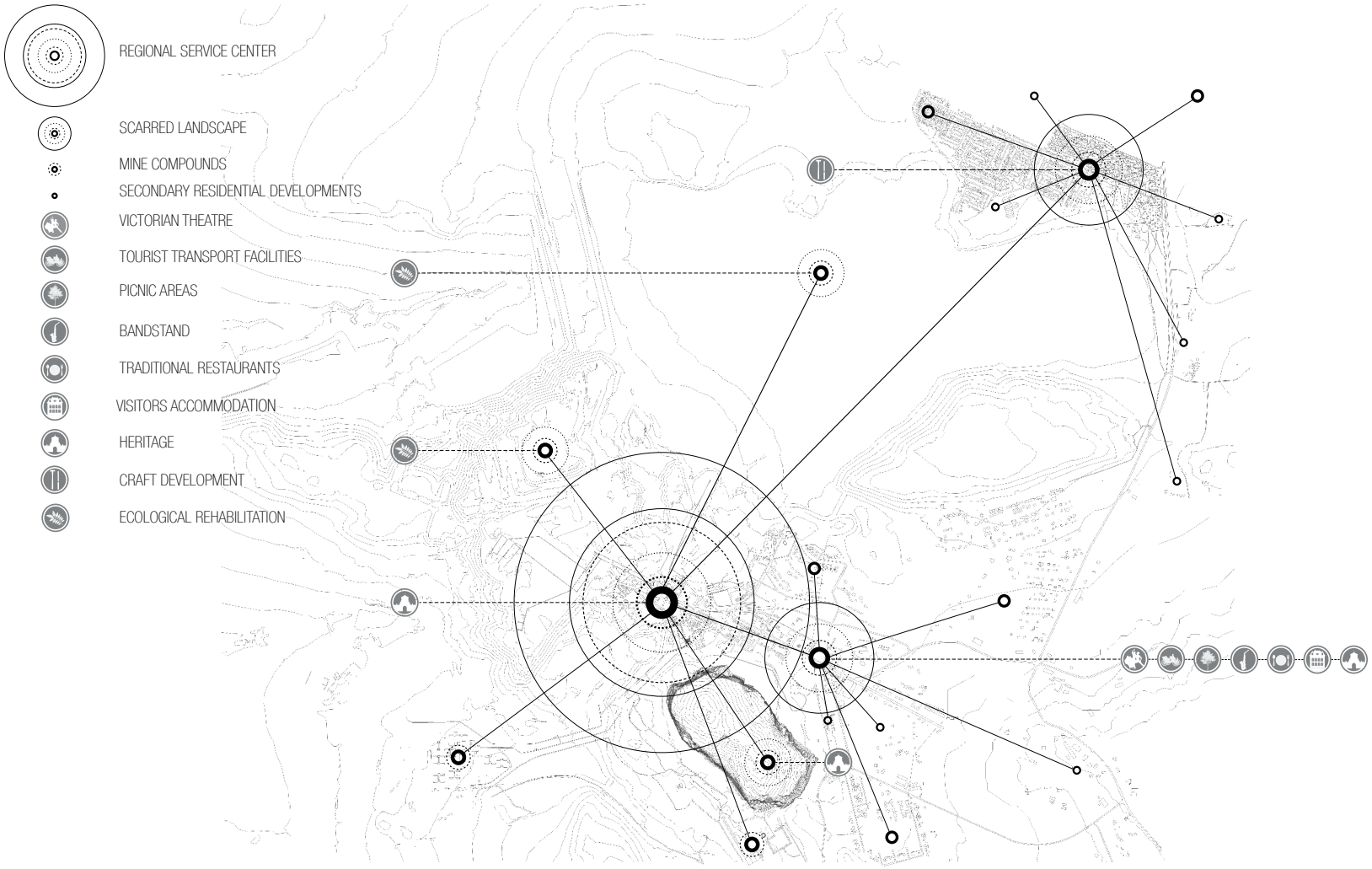
Cullinan is significant for its heritage tourism, as a dormitory town and a weekend getaway for residents of Gauteng's urban areas, and as an agricultural hub. Heritage is seen as a resource that provides revenue and creates a market for new products. The town has intrinsic tourism value and is seen as a window into diamond mining and Victorian Africa, thus tourism-focused development should be associated with diamond mining, Victorian history in Africa, rural living, and the Italian prisoners of war.

Development in Cullinan should, however, not become exclusive and elitist by only catering for tourists, but should involve the local unemployed community. This involvement can be achieved by providing the local community with a means of generating income, by transferring skills and knowledge and by uplifting them in order to improve and sustain their quality of life. Urbanization needs to contribute to local economic development while responding to the heritage of the town. A new resilient means of generating resources and income or providing opportunities for economic development is thus required in order to sustain the town. The heritage of agriculture can inform new resilient agricultural practices which could provide the local community with economic opportunities and ensure future economic development.

The proposed group vision is thus to re-establish resilient agricultural practices, to propose a series of new productive industries that process the produced agricultural crops into products that generate a new form of revenue, and to establish new educational facilities that provide for the transfer of skills, knowledge and technology to the local community.

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VISUAL REPRESENTATION OF PROPOSED DINOKENG DEVELOPMENT FRAMEWORK



4.2_ Visual representation of proposed Dinokeng development framework

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PROPOSED URBAN FRAMEWORK /

INTENTIONS:

The original interconnected relationship that once existed between the town, the mine and the landscape has been lost. In response to this, the proposed urban framework will investigate how the existing fragmented components and areas within Cullinan can be stitched together to establish an interconnected relationship between them. These components are:

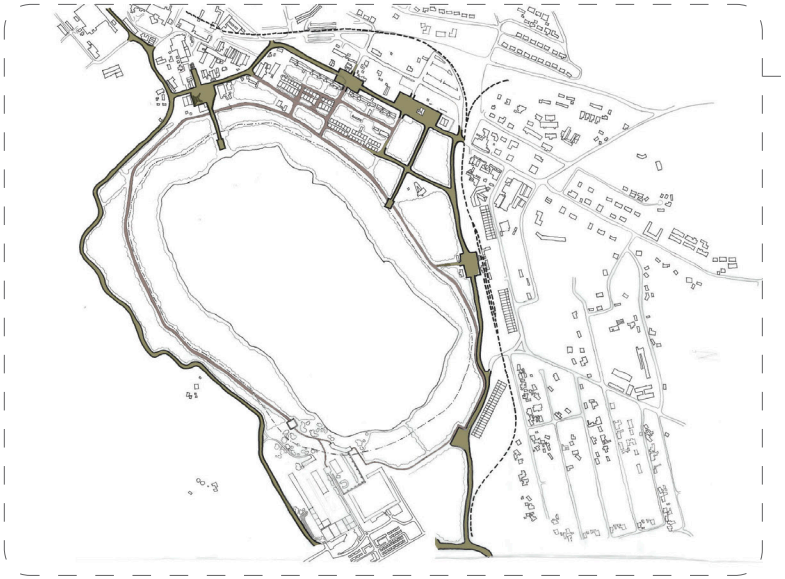
- The historical compounds
- The railway station
- The ventilation shaft
- The culinary node
- The area of the mine surrounding the No. 1 Shaft and Headgear

This will be achieved by means of a new primary spatial structure that is proposed as a circle route around the open pit. It connects the various areas to each other but also becomes a scenic circle route for visitors to Cullinan (see **Figure 4.3**). Along this primary spatial structure a series of public squares are established at crucial points (see **Figure 4.3**), creating social, economic and cultural opportunities. The surrounding commercial, public and cultural ventures feed into these public squares and draw energy and potential from them. These public squares are located within 5 minutes' walking distance from one another, allowing them to be connected by means of pedestrian circulation routes.

The wide sidewalk currently running along Oak Avenue, as shown in **Figure 4.3**, is extended to connect with the new public square proposed at the mine. From this primary spatial structure the secondary spatial structure branches off towards the open-pit excavation, establishing new connections to the historical fabric of the mine, the town, and various viewing points around the edge of the excavation.

New visitors' accommodation units are proposed along the edge of the excavation to allow for a view towards the open pit on one side, while spilling out onto a public green space on the other side contained by the historical fabric of the town on its northern edge (see **Figure 4.3**). This allows for a visual connection with the excavation while maintaining a public interface along Oak Avenue.
A productive agricultural belt is established around the western edge of the excavation to provide the local community with agricultural opportunities, to remediate the scarred landscape by transforming it into a productive landscape, and to provide raw material to the new proposed productive industries.

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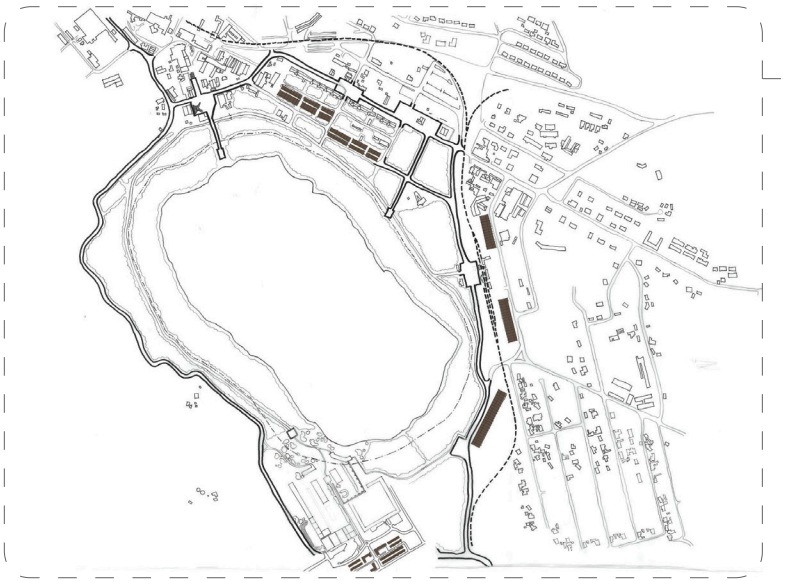


4.3_ Diagram showing new primary and secondary routes within the proposed urban framework (Cullinan Group, 2014).

PRIMARY AND SECONDARY ROUTES

Primary Route
Secondary Route

Description:
The Primary route focuses on connecting the decommissioned mine; the existing town and the old mining compounds. The route continues around the excavated hole allowing people to view the scar in the landscape from all angles. Along the primary route new public squares have been designed to define certain areas of the town and to create more of a pedestrian friendly route where shops and restaurants can spill out onto these spaces.
The Secondary Routes are then allocated closer to the hole. These routes are designed for pedestrians and bicycles. It allow people to meander around the hole to the different interventions and viewing points.



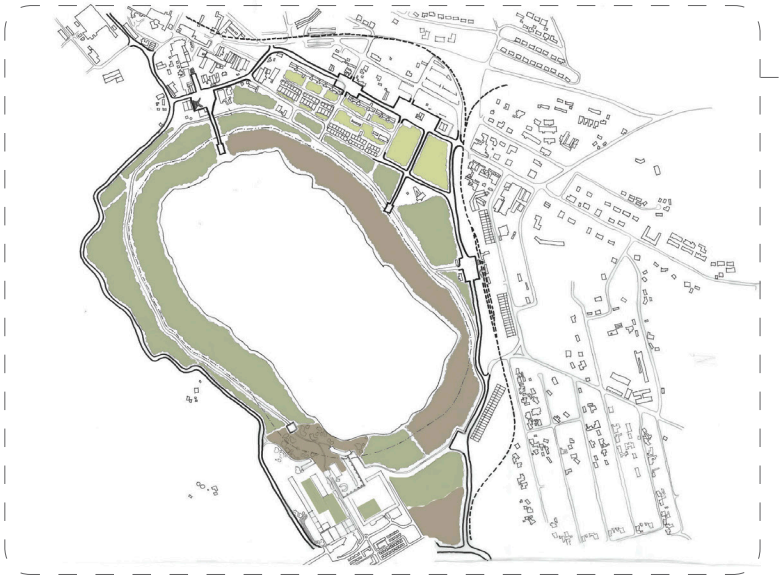
4.4_ Diagram showing the new proposed development within the proposed urban framework (Cullinan Group, 2014).

NEW DEVELOPMENT

New Development

Description:
The new development throughout the town will mainly contain accommodation and facilities for agricultural based education.
This development is again centred around the scar in the landscape and provides a further connection between the town and mining compound

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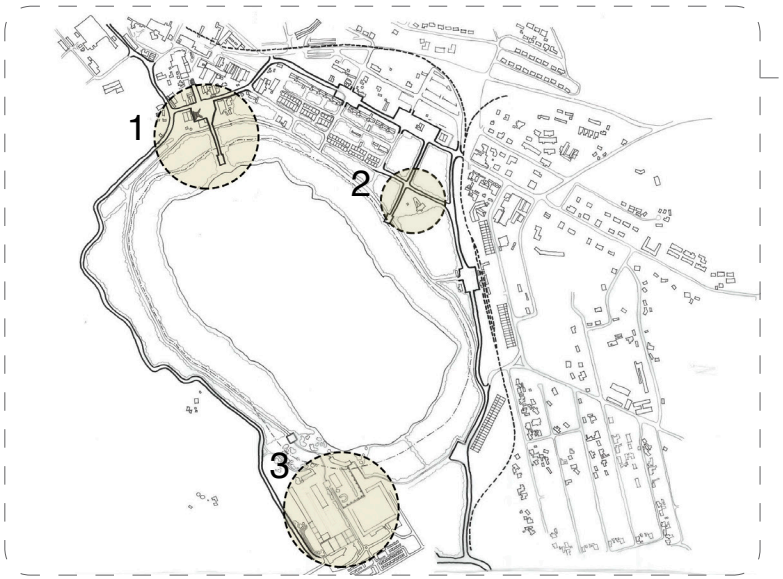


GREEN SPACES

Natural Bushveld
Productive land
Recreation space

Description:
The existing landscape has been developed into a productive landscape where all the new interventions plug into.
On the eastern side of the hole the natural bushveld has been retained with smaller sections of production closer to the town.
The main belt of productive landscape is allocated on the western side of the hole. This agriculture contains orchards, hemp, and vegetable farming.
Along Oak Avenue (the main street in town) new recreational green spaces have be designed for the new accommodation as well as a space for festivals and events.

4.5_ Diagram showing green spaces within the proposed urban framework (Cullinan Group, 2014).



SITE ALLOCATIONS

1	MINE:	Walter Raubenheimer Marcel Mattheus
2	TOWN:	Nikita Edwards
3	COMPOUND:	Natasha Laurent Paige Du Toit Hugo van Niekerk (landscape Architect)

4.6_ Diagram showing site locations within the proposed urban framework (Cullinan Group, 2014).

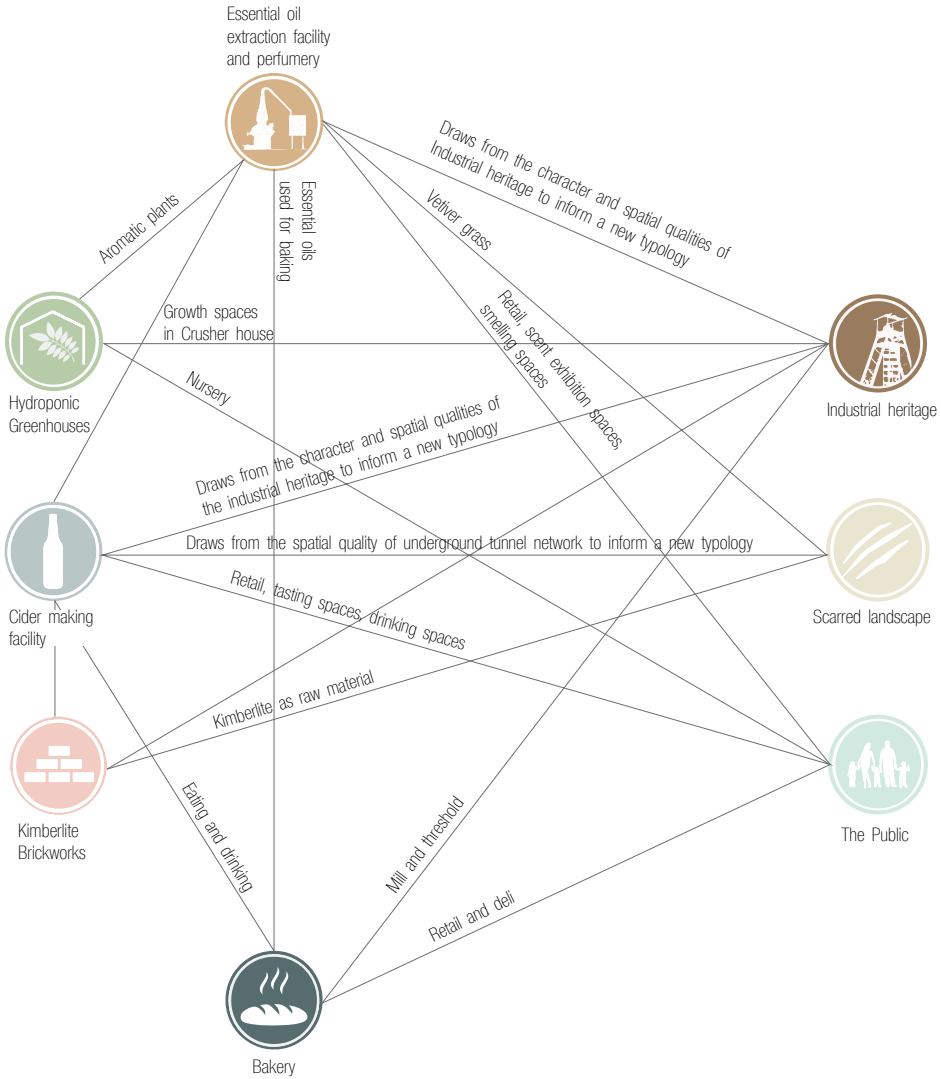
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MASTER PLAN/



4.7_ Master plan of urban framework (Cullinan Group, 2014).

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4.8_ Diagram showing interconnected relationships between new industries, the industrial heritage, the scarred landscape and the public (Author, 2014).

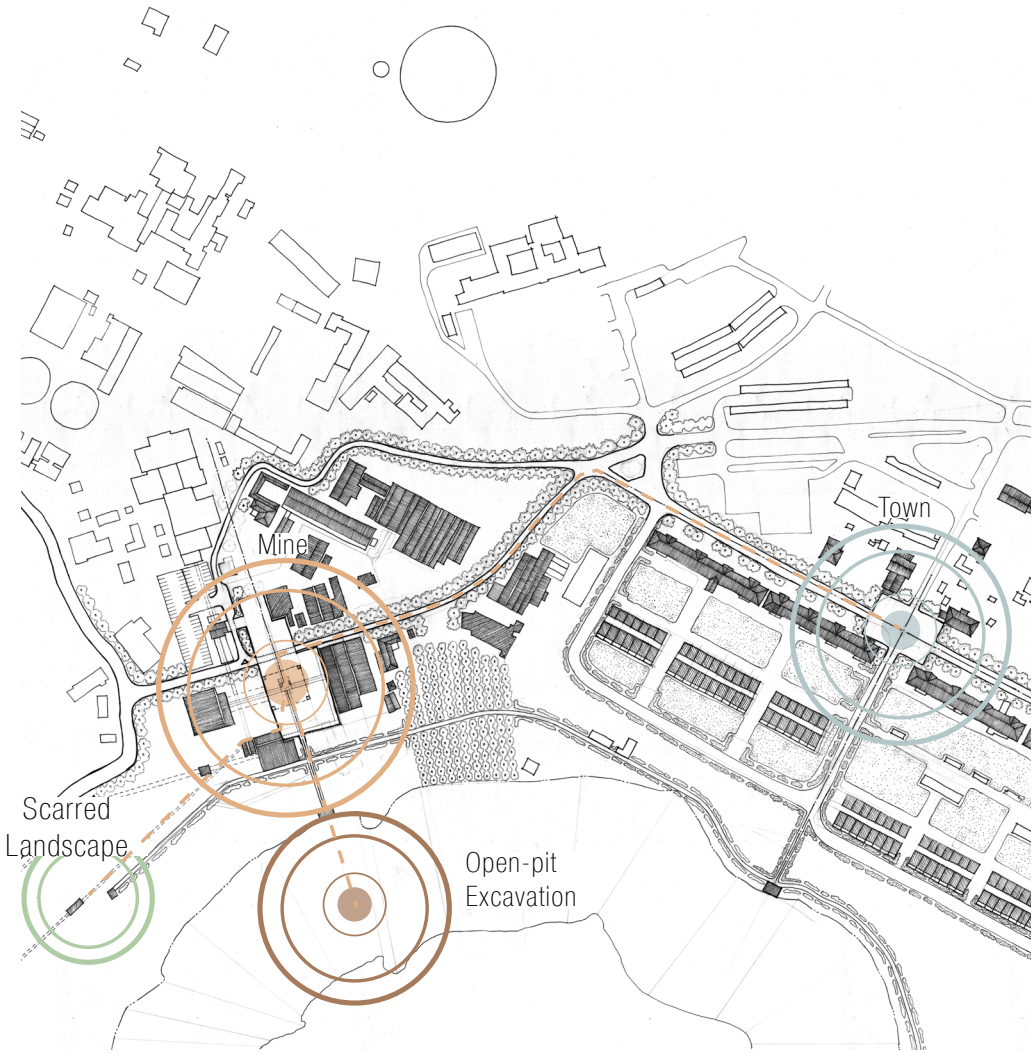
PRECINCT FRAMEWORK:

INTENTIONS:

The precinct framework needs to establish a sustainable, resilient future for the industrial heritage of the decommissioned mine. It was discovered that resilience in a man-made system such as a mine can be increased by distributing its function across many smaller components. The mine in Cullinan serves the function of extracting resources and providing a source of revenue to the local community. Following its decommissioning it will be unable to fulfill its function of production, becoming redundant and purposeless.

In response to this the precinct framework proposes an interconnected network of new multi-functional productive industries within the mine. This network redefines the productive capacity of the mine and distributes its functions across many smaller components. Interconnected relationships are established between these industries and the ecological, social and cultural aspects of the site (see **Figure 4.4**). The existing infrastructure of the mine will be adaptively re-used to provide the necessary services to the new productive industries. Existing buildings and structures at the decommissioned mine will be adaptively re-used according to the principles discussed in Chapter 3 so as to maintain their heritage significance while enhancing their character. A new public interface will be established in the form of a public square and event space. This square would provide a contained space for lingering and events which the public part of the proposed industries can spill out onto.

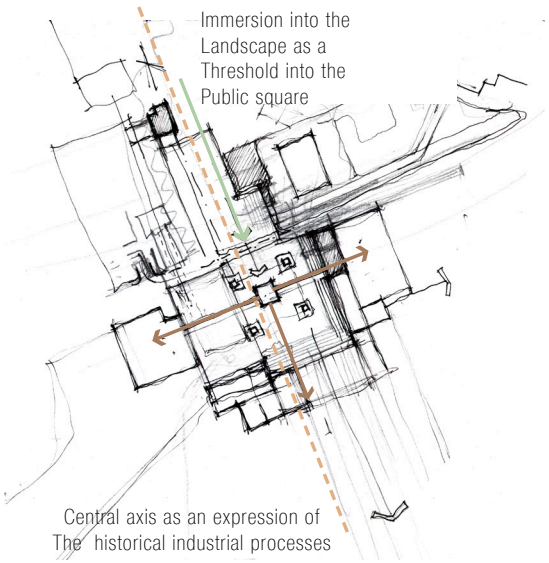
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4.9_ Re-establishing lost connections (Author, 2014).

CONCEPTUAL DEVELOPMENT:

The precinct framework is developed as an expression of the historical industrial narrative along an axis (see **Figure 4.5**) which aligns the three shafts and their headgears and which relates to the movement of men and material. The public square is envisioned as a partly excavated space that facilitates immersion in the landscape, reinterpreting the historical narrative of descending into the earth in order to extract resources. This space becomes a contained, protected space that allows for repose and events before engaging with the surrounding post-industrial environment on different levels.



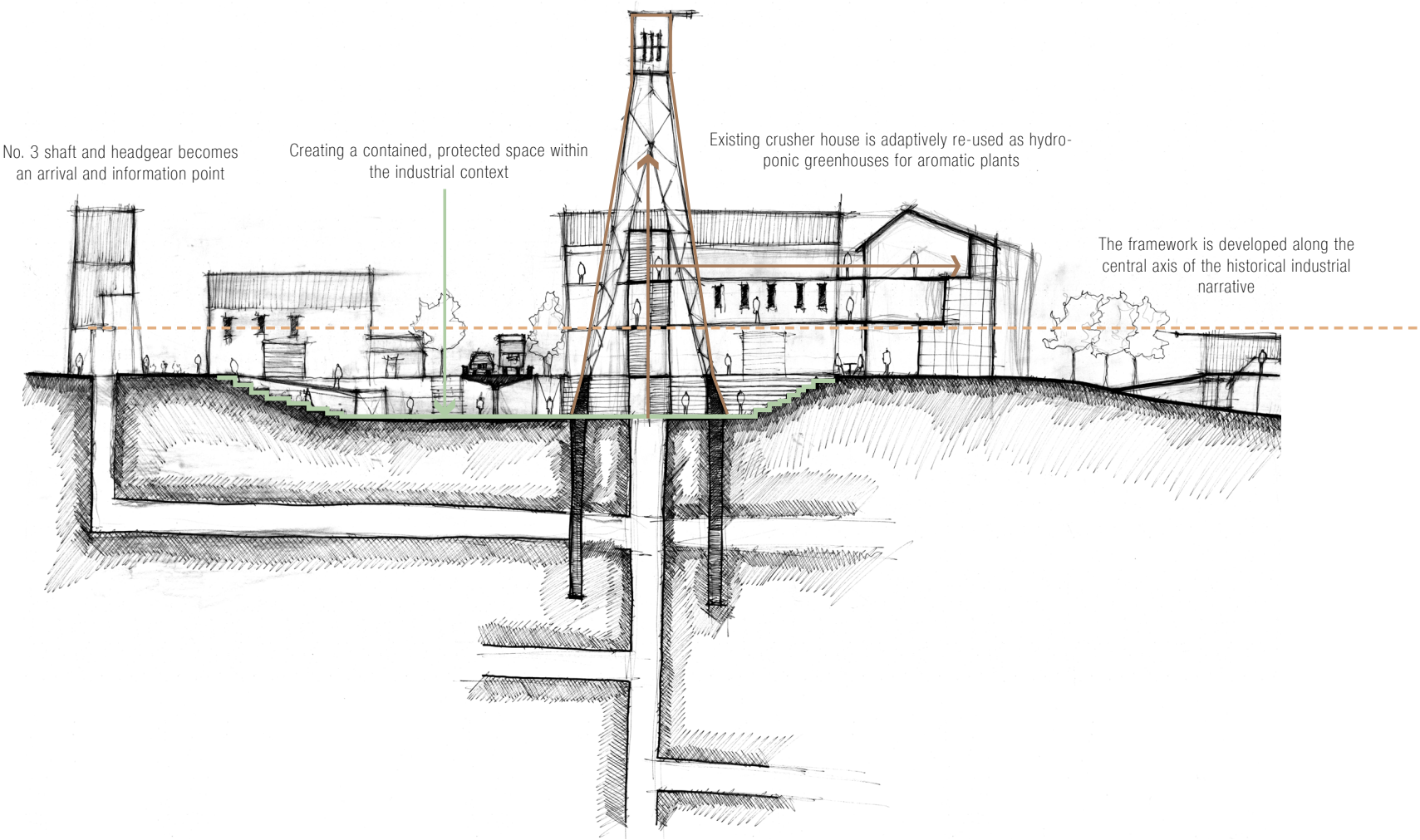
4.10_ Conceptual development of framework narrative (Author, 2014).

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CONCEPTUAL SECTION 01 OF PRECINCT FRAMEWORK:

No. 1 Shaft Headgear, being a significant landmark and orientation point at the mine, is accentuated as an object in space by the partial excavation of the public square. It is adaptively re-used as a central vertical circulation point, reinterpreting its historical function of extracting ore vertically from the earth.

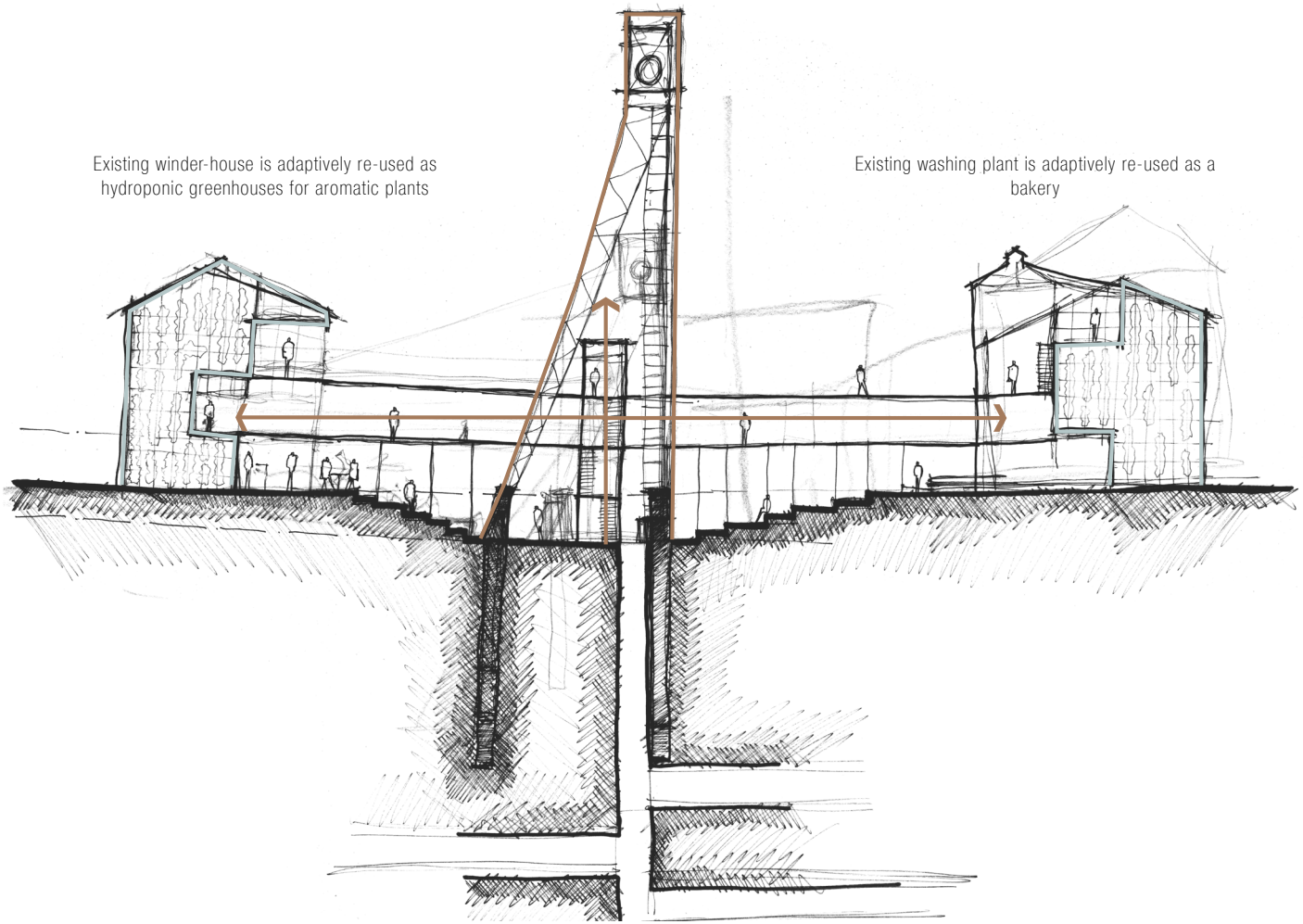


4.11_ Conceptual longitudinal section through the proposed Precinct framework (Author, 2014).

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CONCEPTUAL SECTION 02 OF PRECINCT FRAMEWORK:

No. 1 Shaft Headgear is adaptively re-used as a central circulation point directing movement into the surrounding buildings.



4.12_ Conceptual cross section through the proposed Precinct framework

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PRECINCT FRAMEWORK / NORTHERN BIRDS-EYE VIEW

HISTORICAL WAREHOUSES:
ADAPTIVELY RE-USED AS CONFERENCE FACILITIES AND VISITORS ACCOMMODATION

HISTORICAL WAREHOUSES:
ADAPTIVELY RE-USED AS A KIMBERLITE BRICKWORKS

NO. 3 SHAFT HEADGEAR:
ARRIVAL POINT, INFORMATION CENTRE, UNDERGROUND TOURS

PROPOSED VISITORS PARKING

NO. 1 SHAFT HEADGEAR:
LANDMARK, BEACON, PUBLIC VERTICAL CIRCULATION

WASHING PLANT:
NEW PROPOSED MILL AND BAKERY

CRUSHER BUILDING:
PROPOSED Hydroponic AROMATIC PLANT GREENHOUSE, CONVEYOR BELT SYSTEM ADAPTIVELY RE-USED TO TRANSPORT HARVESTED VETIVER GRASS CROPS

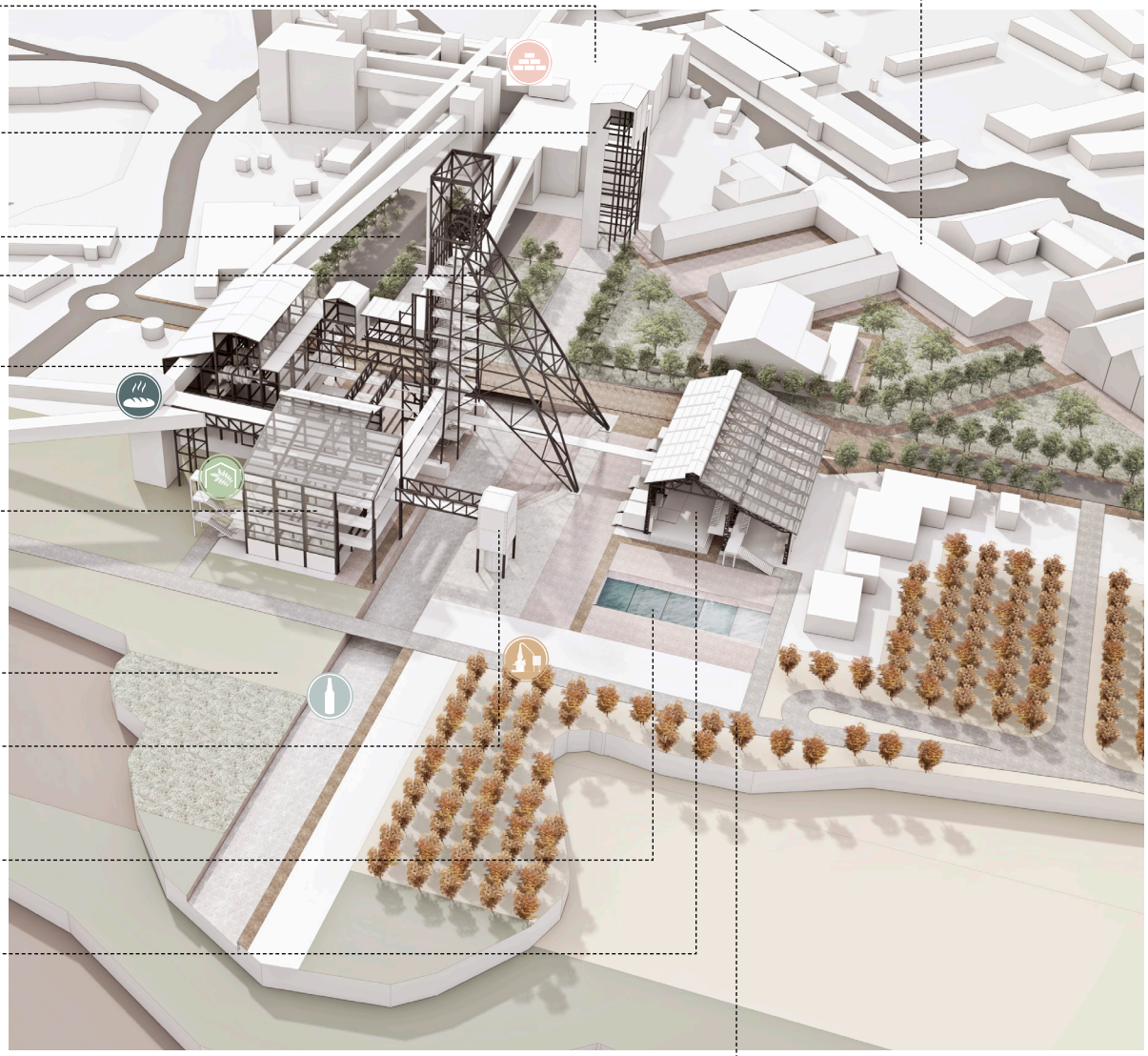
PROPOSED VETIVER GRASS PLANTATIONS

WATER TOWER AND PUMPING HOUSE:
ADAPTIVELY RE-USED WATER SUPPLY INFRASTRUCTURE

PROPOSED FRESH WATER RETENTION POND:
FRESH WATER AND RAINWATER STORAGE

WINDER HOUSE:
PROPOSED Hydroponic GREENHOUSE NEW PUBLIC RETAIL: SPICE SHOP, ROASTER Y AND COFFEE SHOP, DELI

PROPOSED ORCHARDS



4.13_ Precinct framework Northern birds eye view (Author, 2014).

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PRECINCT FRAMEWORK / SOUTHERN BIRDS-EYE VIEW

WASHING PLANT:
NEW PROPOSED MILL AND BAKERY

NO. 1 SHAFT HEADGEAR:
LANDMARK, BEACON, PUBLIC VERTICAL CIRCULATION

CRUSHER BUILDING:
PROPOSED Hydroponic AROMATIC PLANT GREENHOUSE, CONVEYOR BELT SYSTEM ADAPTIVELY RE-USED TO TRANSPORT HARVESTED VETIVER GRASS CROPS

PROPOSED FRESH WATER RETENTION POND:
FRESH WATER AND RAINWATER STORAGE

PROPOSED ORCHARDS

WINDER HOUSE:
PROPOSED Hydroponic GREENHOUSE NEW PUBLIC RETAIL: SPICE SHOP, ROASTER Y AND COFFEE SHOP, DELI

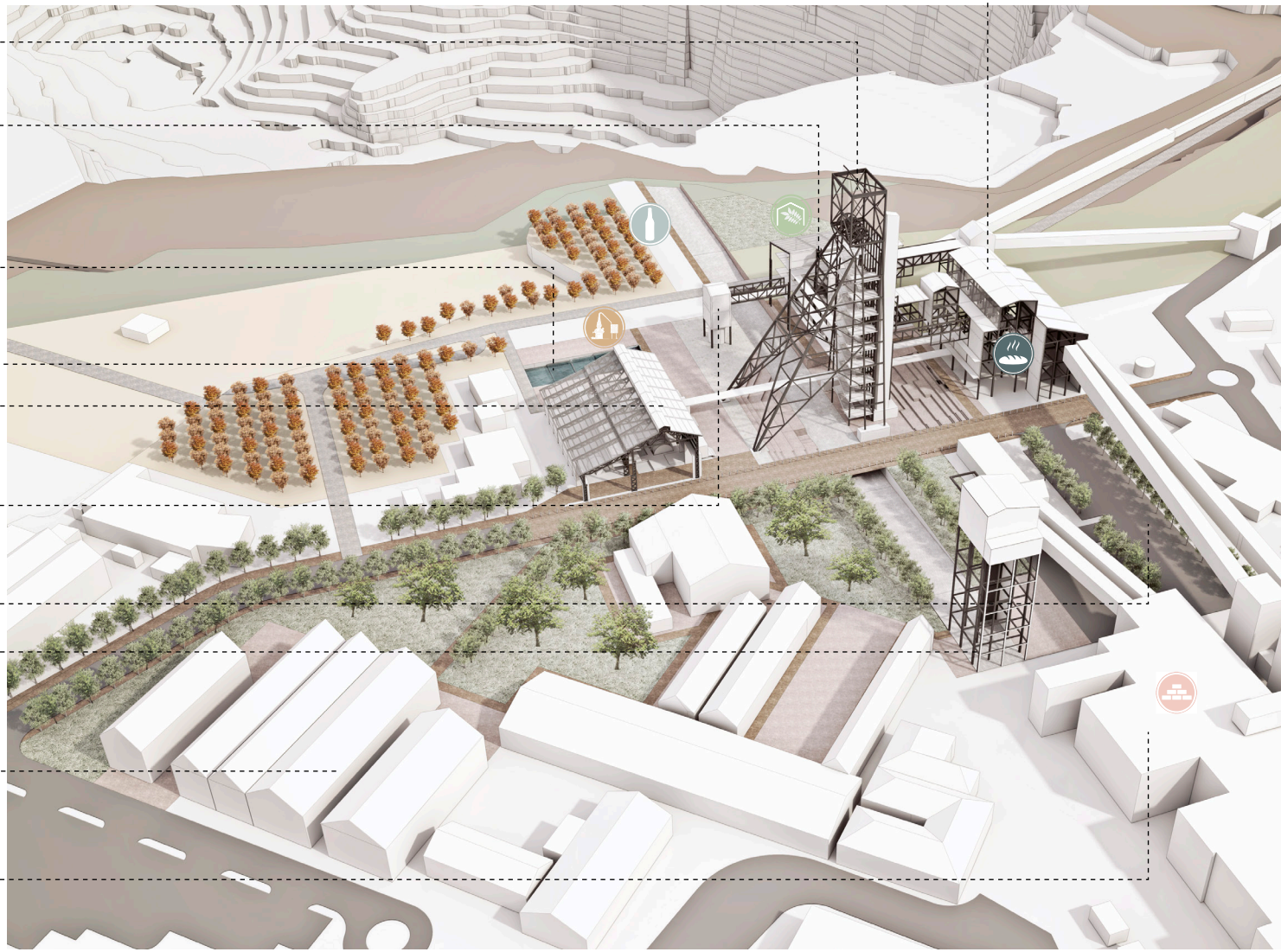
WATER TOWER AND PUMPING HOUSE:
ADAPTIVELY RE-USED WATER SUPPLY INFRASTRUCTURE

PROPOSED VISITORS PARKING

NO. 3 SHAFT HEADGEAR:
ARRIVAL POINT, INFORMATION CENTRE, UNDERGROUND TOURS

HISTORICAL WAREHOUSES:
ADAPTIVELY RE-USED AS CONFERENCE FACILITIES AND VISITORS ACCOMMODATION

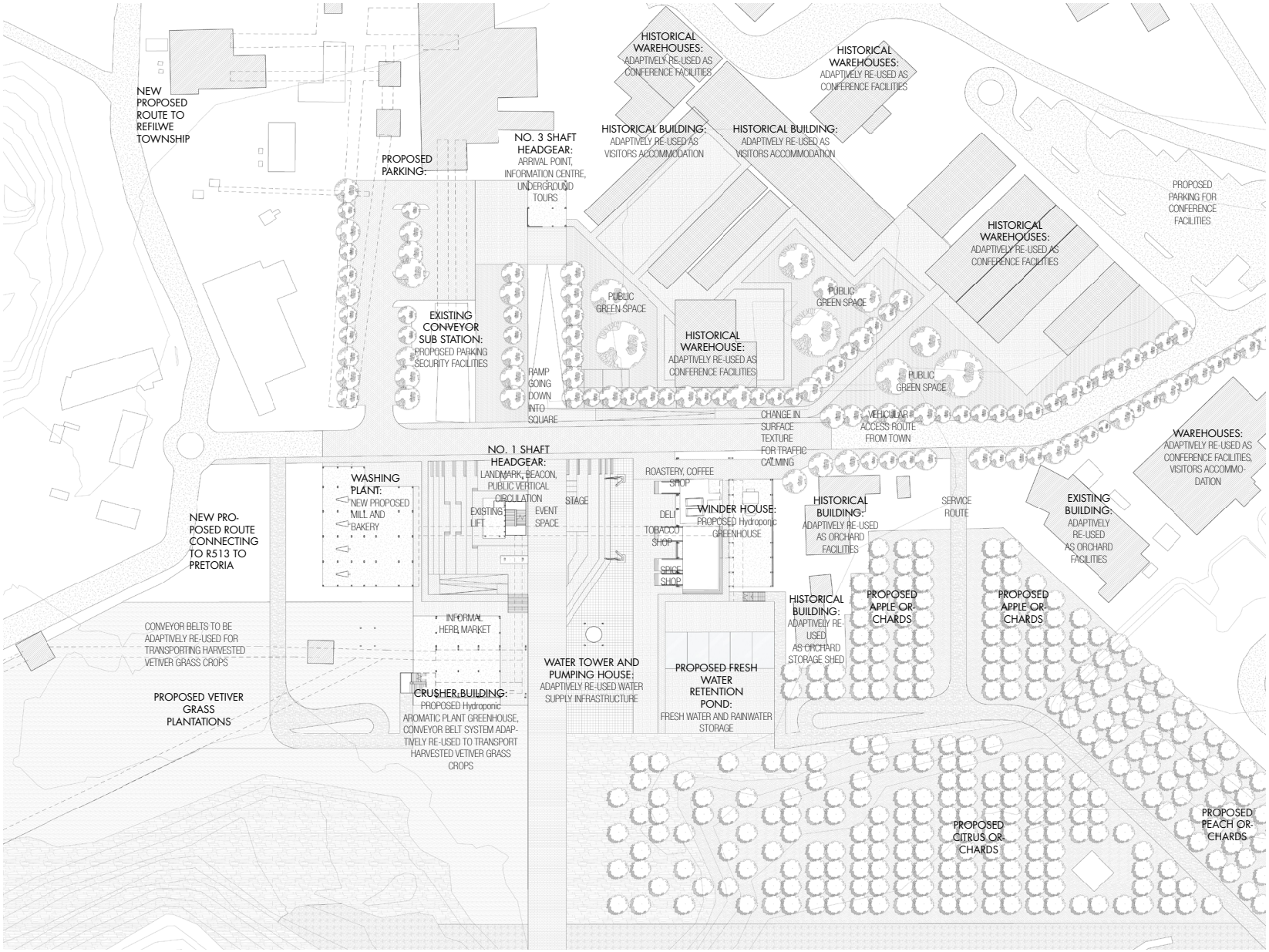
HISTORICAL WAREHOUSES:
ADAPTIVELY RE-USED AS KIMBERLITE BRICKWORKS



4.14_ Precinct framework Southern birds eye view (Author, 2014).

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PRECINCT FRAMEWORK / SITE PLAN

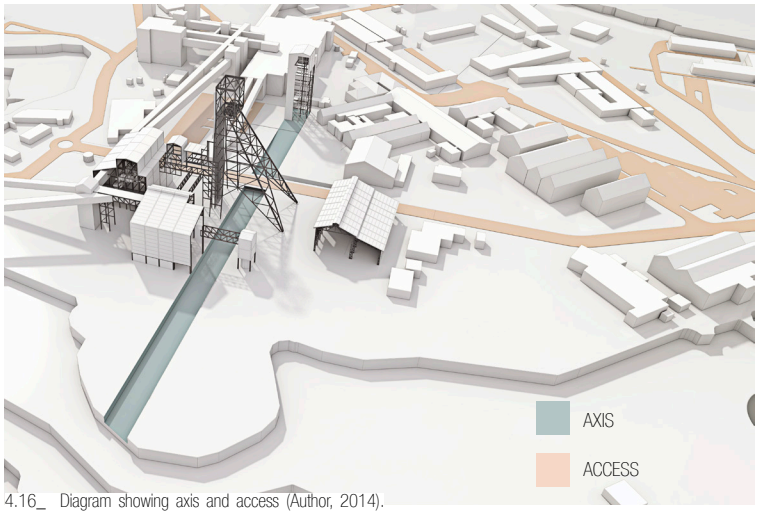


4.15_ Precinct framework Northern birds eye view (Author, 2014).

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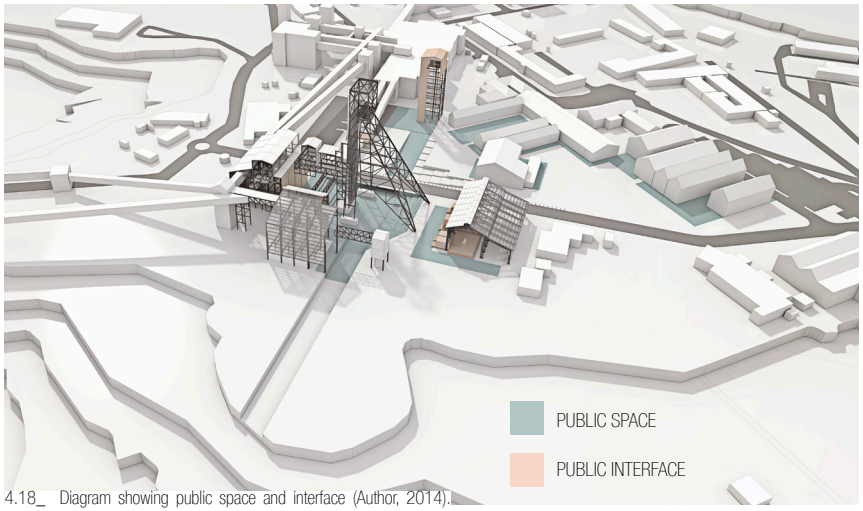
PRECINCT FRAMEWORK / EXPLANATORY DIAGRAMS

AXIS AND ACCESS:



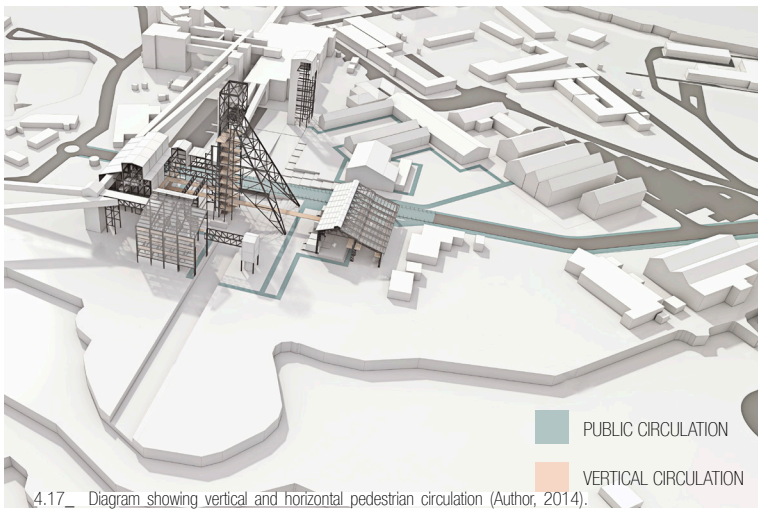
4.16_ Diagram showing axis and access (Author, 2014).

PUBLIC SPACE AND PUBLIC INTERFACE:



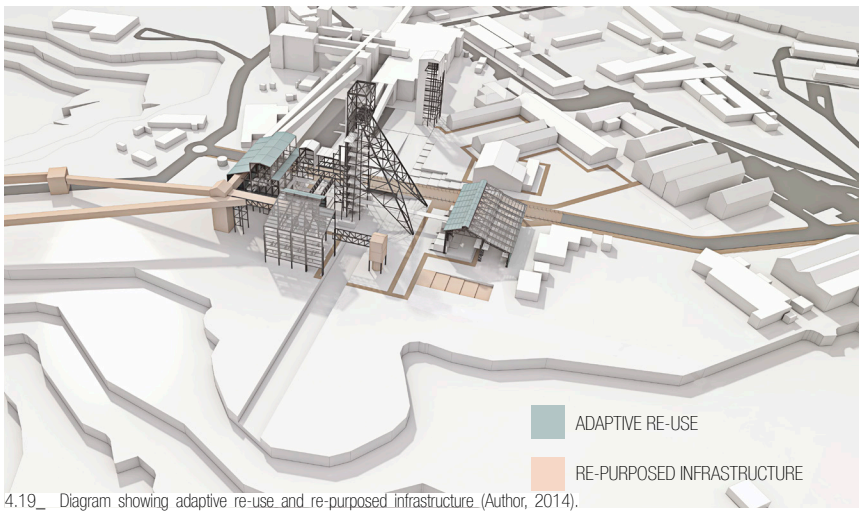
4.18_ Diagram showing public space and interface (Author, 2014).

VERTICAL AND HORIZONTAL PEDESTRIAN CIRCULATION:



4.17_ Diagram showing vertical and horizontal pedestrian circulation (Author, 2014).

ADAPTIVE RE-USE AND RE-PURPOSED INFRASTRUCTURE:



4.19_ Diagram showing adaptive re-use and re-purposed infrastructure (Author, 2014).

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PRECINCT FRAMEWORK/ NARRATIVE

01_PUBLIC SQUARE VIEWED FROM ARRIVAL ROUTE



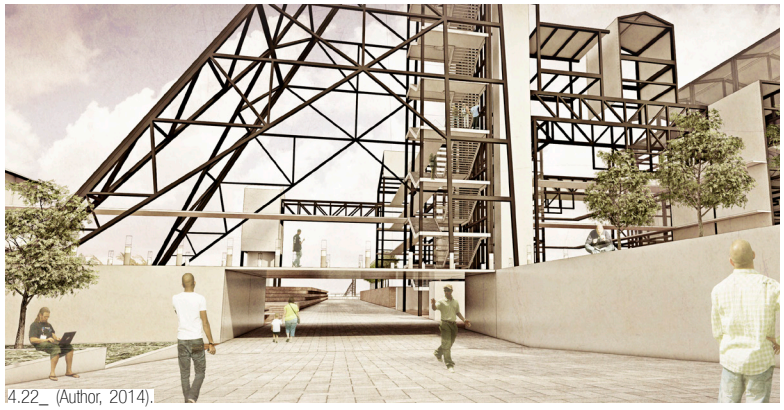
4.20_ (Author, 2014).

02_VIEW DOWN CENTRAL AXIS TOWARDS PUBLIC SQUARE



4.21_ (Author, 2014).

03_APPROACHING THE THRESHOLD INTO THE PUBLIC SQUARE MOVING ALONG THE CENTRAL AXIS



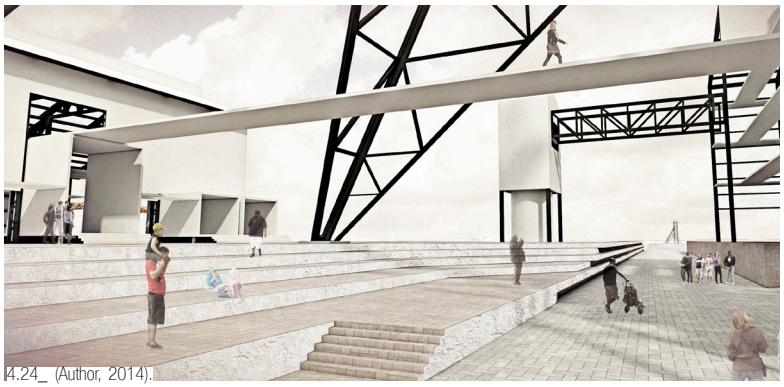
4.22_ (Author, 2014).

04_VIEW OF PUBLIC SQUARE FROM UNDERNEATH THE THRESHOLD



4.23_ (Author, 2014).

05_PUBLIC SQUARE AND EVENT SPACE WITH VIEW ALONG AXIS TO HISTORICAL NO. 2 HEADGEAR



4.24_ (Author, 2014).

06_VIEW OF THE OPEN-PIT EXCAVATION



4.25_ (Author, 2014).

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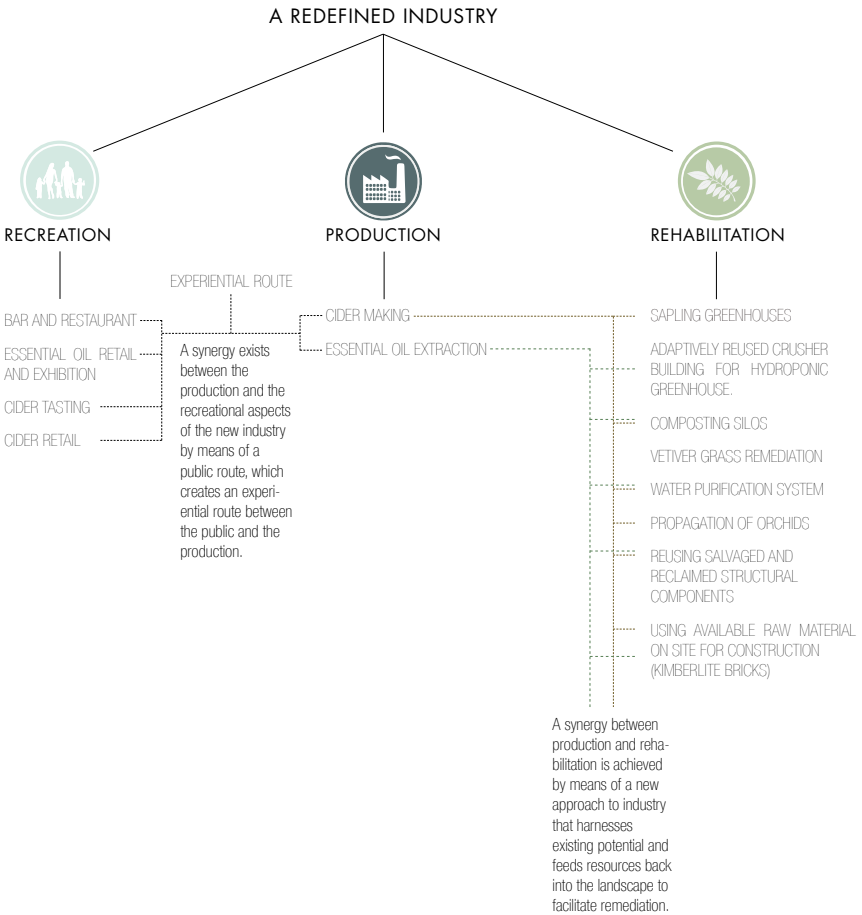
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CHAPTER 05 / DEFINING THE MECHANICS OF CONSTRUCTIVE EXTRACTION _ Program

5.1_ (Lincoln : 2011, edited by author)

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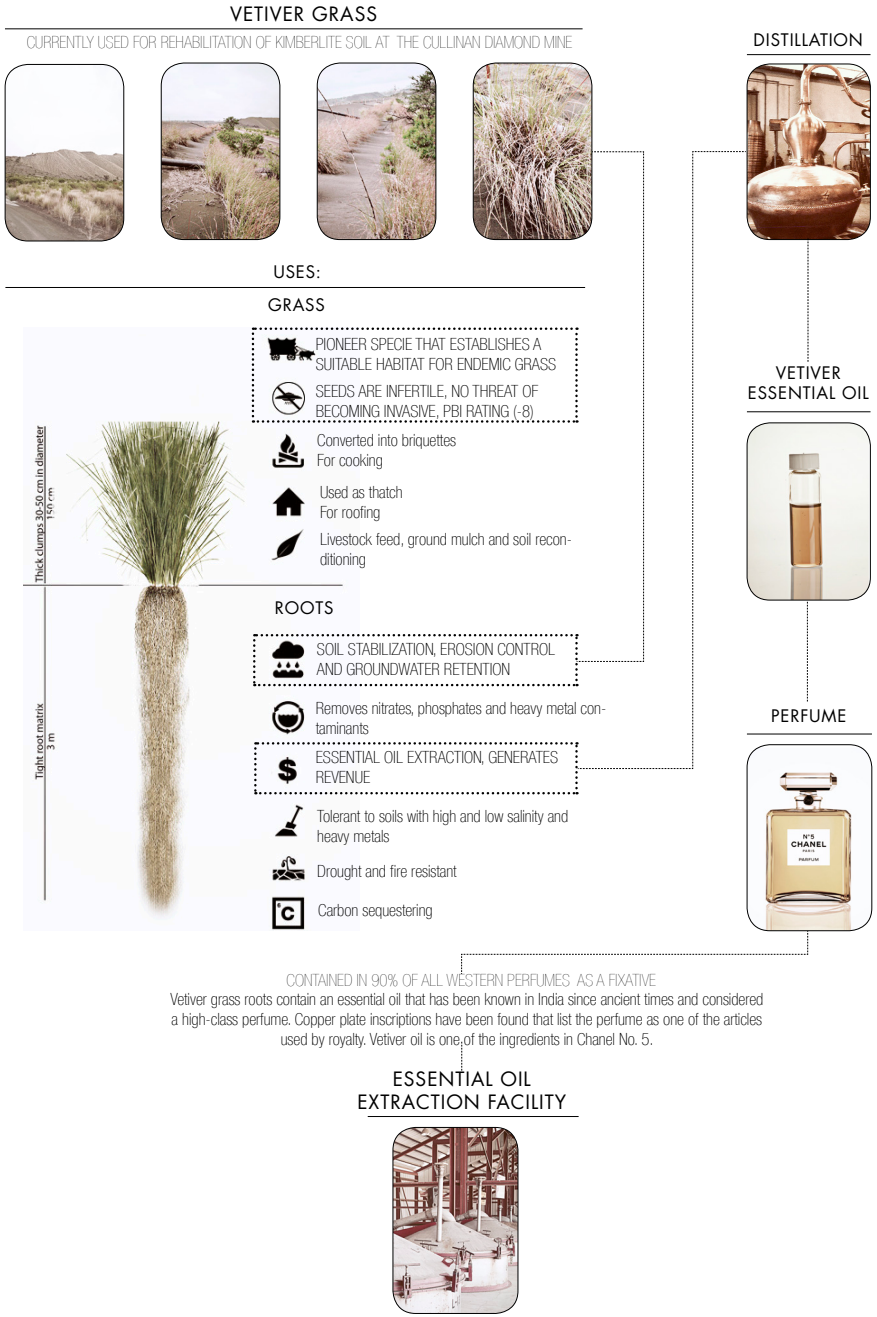
5._ Various components of the programme showing the synergies between them (Author, 2014).

PROGRAM / 005

INTRODUCTION /

For more than a century the mine has extracted its environment, uncovering layer after layer of raw earth to obtain from it compressed carbon with fabricated value. This destructive extraction has created vast mountains of earth and dug enormous scars as gaping holes in the landscape. The proposed program explored by the architecture will endeavor to return meaning and value to the scarred environment. It moves from a destructive to a constructive extraction, which draws from the existing scarred environment to inform a new typology and establish a new relationship with its surroundings. The program related to this constructive extraction should therefore rejuvenate the scarred landscape by finding new value in it. This value can be expanded to provide the community with a new source of revenue while maintaining a mutually beneficial relationship with its environment.

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5.3_ Programmatic informants for an Essential oil extraction facility and perfumery (Author, 2014).

PROGRAMMATIC INFORMANTS/

VETIVER GRASS:

Through an investigation of the opportunities and potential that exist on the site, it was discovered that Vetiver grass is one of the only species successful in rehabilitating infertile kimberlite tailings. According to Knoll (1997: 43), Mark Berry, the De Beers Group ecologist, explains that Vetiver grass has been found to have all the necessary attributes for self-sustainable growth on kimberlite spoils. It has been found to grow vigorously, contain run-off, arrest erosion and create an ideal micro-habitat for the establishment of indigenous grass species. Berry continues that it has proved extremely successful on kimberlite fines at Cullinan where slopes of up to 35 degrees are being stabilised. He concludes that the species is likely to play an increasingly important role in remediation and, as such, nurseries are being established at several mines (Knoll 1997: 43).

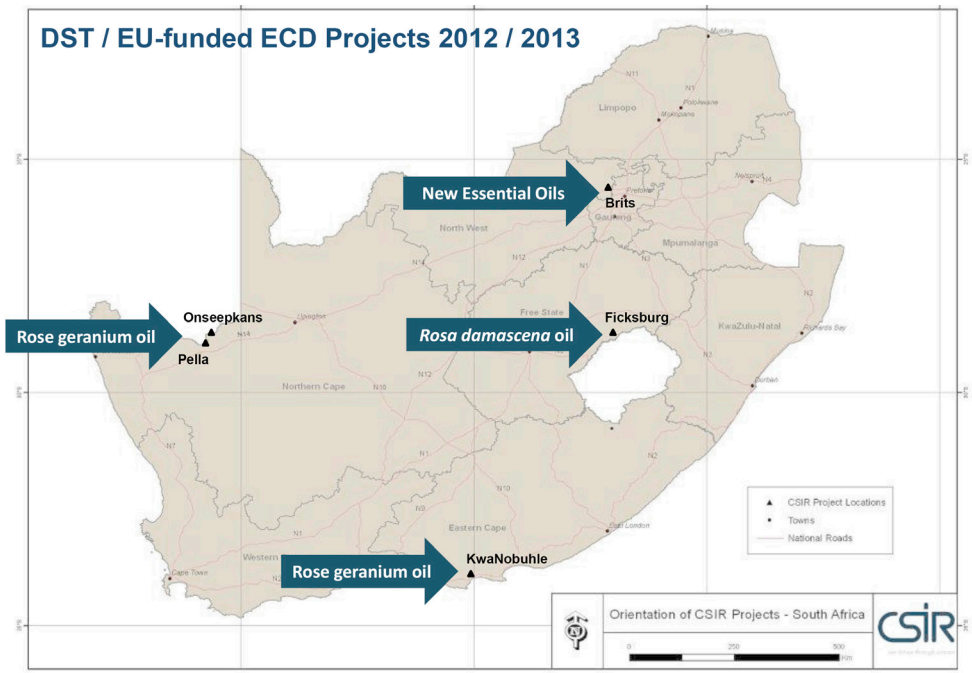
ESSENTIAL OIL EXTRACTION:

Further research into Vetiver grass led to an unexpected discovery, namely that its roots contain an essential oil that has been known since ancient times and is considered a high-class perfume. Vetiver oil is one of the ingredients in Chanel No. 5 and it is currently used as a fixative in 90% of all western perfumes. It is also used as a flavoring agent in milk beverages, ice creams, mixed beverages and as a dessert topping. Furthermore, it has antiseptic, antispasmodic and rubefacient properties which makes it appropriate for use in aromatherapy (NCRS 2009: 2).

CONCLUSION:

In response to these findings a program is formulated in the form of an essential oil extraction facility, which extracts essential oils from the Vetiver grass currently used to rehabilitate the kimberlite tailings. Other essential oil crops are proposed to be grown hydroponically within a greenhouse structure inserted into the existing crusher building. The social components of this programme involve an experiential route through the production spaces allowing visitors to engage with the production process as well as an essential oil exhibition and retail space. This program facilitates the transformation of a scarred landscape into a productive landscape, while providing the local community with a new source of revenue and making the industrial heritage more resilient by creating another layer within it that enriches the visitors experience.

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5.4_ Map showing location of CSIR initiated essential oil extraction projects in South Africa (Author, 2014).



5.5_ Drip irrigation at essential oil extraction project (Kellerman, 2012).



5.7_ Nursery at Onseepkans essential oil extraction project (Kellerman, 2012).



5.6_ Harvesting Rose geranium at Onseepkans project (Kellerman, 2012).



5.8_ Hydro-distillation unit at Onseepkans project (Kellerman, 2012).

ESSENTIAL OIL EXTRACTION IN SOUTH AFRICA:

There are around 3 000 plants globally that are appropriate for the extraction of essential oils, but at the moment only around 300 are being harvested and utilized to this end (Heinsohn 2009: 1). Dr. Louis de Lange, a practicing bio-fertilization expert and CEO of Genesis Sustainable Resources, states that: "Essential oils generate an estimated US$18 billion per annum globally – but Africa (notably Egypt and Morocco) and the Indian Ocean islands (particularly Madagascar and Reunion) are probably responsible for less than 2% of the global figure. We are clearly lagging far behind, although there are signs that things are now beginning to change" (Heinsohn 2009: 1-2). According to De Lange several small artisan essential oil distilleries have achieved significant success in cultivating and extracting their own high-quality essential oils in South Africa. There exists a substantial market for these oils as they form a fundamental part of a variety of different perfumes, cosmetics, soaps, foods, deodorizers and detergents, and are extensively used as flavourants in food products (Heinsohn 2009: 2).

De Lange believes that most farmers in the different regions of the country that are currently providing a range of agricultural produce – be it maize, wheat, wine, citrus fruits, deciduous fruits or even livestock – would benefit significantly by diversifying into essential oil production. To motivate this De Lange states that "the essential oil farming operations in Southern Africa form only a small part of a far bigger agricultural enterprise but it almost always has the potential to be by far the most profitable section of any diversified operation relative to the land it occupies. It is also highly suitable for independent start-up operations, particularly those on the periphery of big cities." De Lange makes it apparent that the failure of most essential oil extraction ventures in South Africa can be attributed to a lack of knowledge and the necessary skills and expertise required to achieve an internationally acceptable product. Due to the fact that essential oils are used in high-profile cosmetics and perfumes as well as food products, they need to adhere to strict international quality criteria. Kellerman (2012: 5), who is affiliated with the Council for Scientific and Industrial Research (CSIR), believes that these obstacles can be overcome by means of sufficient training and skills development in the field of agro-processing, and by an effective transfer of technology, informed management, adequate community involvement and appropriate support. Kellerman (2012: 3) states that often subsistence farmers in developing countries such as

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5.9_ Boiler room at Onseepkans project (Kellerman, 2012).



5.12_ Distillation unit at Onseepkans project (Kellerman, 2012).





5.10_ Building the extraction factory at Onseepkans (Kellerman, 2012).



5.13_ Aromatic plants at the Brits essential oil project (Kellerman, 2012).

Province	Species	TOTAL ha
Mpumalanga	Vetiver, Citronella, Lippia, Eucalyptus, Artemisia, Rosemary, Geranium, Lemon grass	943
Free State	Tagete, Artemisia, Lavendin	70
Northern Cape	Marjoram, Rosemary, Lavendin	45
North West	Geranium, Rosemary, Lavendin, Chamomile	40
Eastern Cape	Geranium, Rosemary, Lavender	200
Western Cape	Eriocephalus, Lavender, Lavandin, Buchu, Rosemary	77
Limpopo & Machado	Lippia, Geranium, Rosemary, Lavendin, Tea tree	91
Gauteng	Lavendin, Rosemary, Artemisia	82
KZN	Lavendin, Rosemary Eucalyptus, Geranium, Tea tree, Lemon tea tree, Spear Mint, Lemon grass, Artemisia, Melissa, Thyme	422
TOTAL		**1970**
These estimates exclude wild harvesting and community projects in progress		

5.11_ Table showing the land utilized for growing essential oil crops in each province in 2010 (Department of Agriculture, forestry and fisheries, 2010)

South Africa can not compete with commercial scale agricultural undertakings to generate an income; therefore, by involving these farmers in commercial scale agro-processing in the form of intensive essential oil crops which require much less land, they are able to cultivate and process high-value crops to produce essential oils which can generate a significant revenue. According to Kellerman (2012: 3) the CSIR in South Africa is involved in the implementation of various essential oil extraction projects, funded by the Department of Science & Technology (DST) and the European Union (EU), as a means of alleviating poverty in various areas throughout the country (see **Figure 5.4**). These projects include a basil, lemon grass and yarrow essential oil extraction facility in Brits, a Rosa damascena essential oil extraction facility in Ficksburg, and Rose Geranium essential oil extraction facilities in Onseepkans, Pella and KwaNobuhle. **Figure 5.5-5.13** depicts these extraction facilities and their various components.

In conclusion De Lange makes the statement that: "It is ironic that although essential oil producers have been in South Africa for a century and despite our Huguenot tradition, we are still lagging behind France and the former French colonies. For many years these have been the front-runners in essential oil production. But, things are beginning to change fast, as more and more local producers develop this potential" (Heinsohn 2009: 2).

It is apparent that essential oil crops and the extraction of essential oils possess significant unharnessed potential within South Africa, employing intensive agriculture which requires less land than conventional agriculture and being able to produce a product with significant economic value. This agro-industrial practice could therefore be an appropriate way of creating a new catalyst that alleviates poverty and unemployment after the decommissioning of the mine at Cullinan. From **Figure 5.11** it becomes clear that the greatest area of land currently being utilized for the cultivation of essential oil crops is in the Mapumalanga province. It also shows that Mpumalanga is the only province where Vetiver essential oil crops are currently being cultivated. Cullinan, situated just 18km from the border of the Mpumalanga province, is therefore in an ideal location for the development of an essential oil extraction facility and perfumery. Local farmers in Cullinan who diversify their current agricultural practices to include essential oil crops could also benefit from this facility

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5.14_ Programmatic informants for the cider-making facility (Author, 2014)

PROGRAMMATIC INFORMANTS /

AGRICULTURAL HERITAGE:

According to Lincoln the Elandsfontein farm, today known as Cullinan, had a significant history of agriculture before prospecting took place. The Minnaar family who once occupied a significant portion of the farm "built a large house and constructed the Minnaars' dam and water irrigation furrows, laid out lands and orchards" (Lincoln 2011: 5).

HERITAGE OF DISTILLING, BREWING , MEDICINAL AND SOCIAL DRINKING:

A strong heritage of distilling exists in the region as is apparent in the Mampoer Festival that is held annually at the nearby Willem Prinsloo Agricultural Museum. This festival celebrates an age-old Dutch settler tradition of distilling mampoer which were passed on from one generation to the next. Lincoln (2007: 15) relates that EA Nathan, the managing director of the mine at the time, stated that in addition to the medicinal treatment of illnesses, some workers were drinking as much as a bottle of brandy daily and that this reduced the mortality rate. This appears to have been common practice, as on 28 November 1906 the Transvaal Public Health Department requested of the Colonial Secretary that the Premier Mine be allowed to purchase Cape Brandy by the cask. The reason offered was that, by issuing it to gangs of workers returning from a shift, the quinine dissolved in brandy would have a positive effect in reducing mortality and sickness rates. Lincoln (2007: 67) also states that many mine workers in the compounds brewed their own traditional beer, which was enjoyed recreationally while playing card games or gambling after shifts.

CONCLUSION:

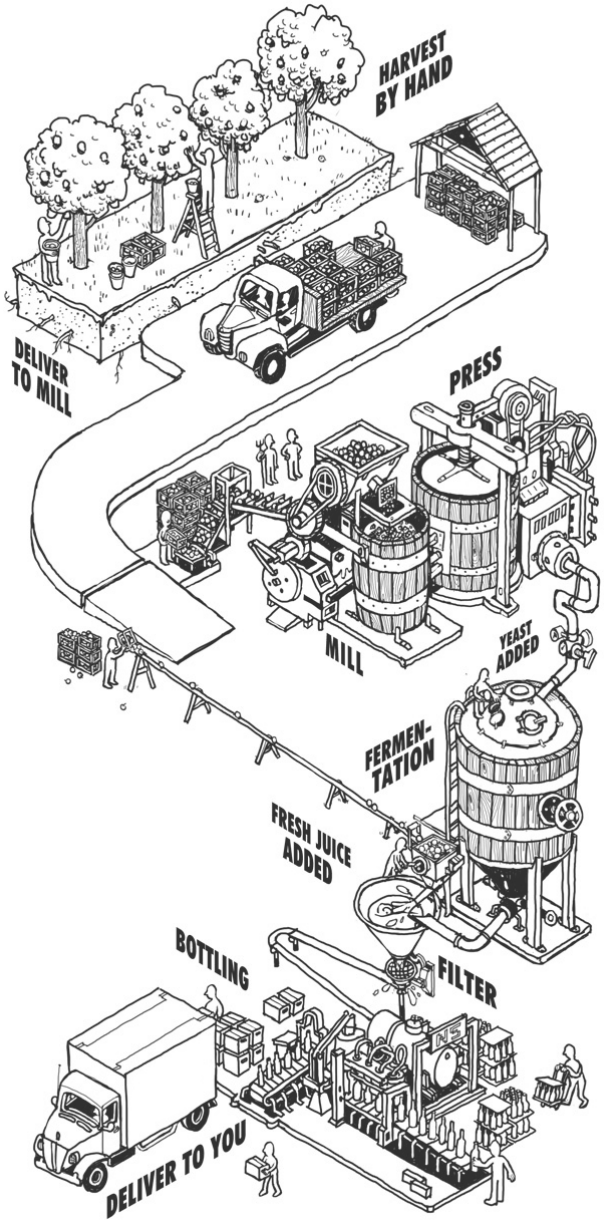
By proposing a cider production facility at the mine as a new productive industry, the agricultural heritage and the heritage of alcohol production at Cullinan can be reconciled and reinterpreted. A connection is re-established with the workers compounds and the town through the historical rituals which took place there. This program also provides the architecture with a more substantial public interface in the form of a series of tasting spaces, a bar, drinking spaces, a restaurant and retail. This public component also includes an experiential public route through the cider-making facility.

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THE CIDER-MAKING PROCESS/



5.15_ Illustration of the cider-making process (Everson cider, <http://www.eversoncider.com/fermenting-process/>)

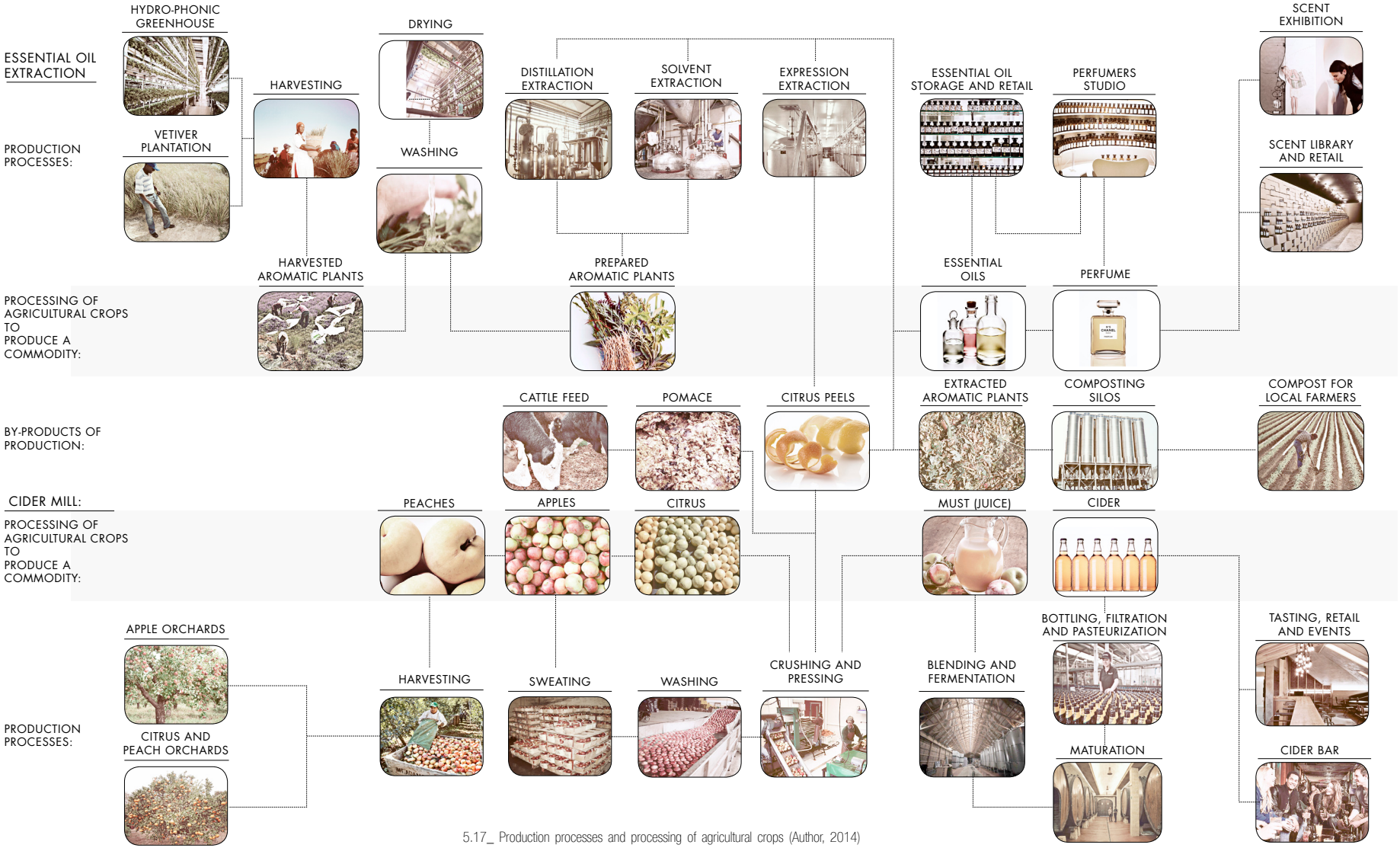


5.16_ Illustration of the various stages of the cider-making process showing the equipment involved in each stage. (Apple Sauced Cider <http://nigelsussman.com/apple-sauced-cider-making-process/>)

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PRODUCTION PROCESSES AND THE PROCESSING OF AGRICULTURAL CROPS:

The waste of the cider-making facility, in the form of fruit peels is provided to expression extraction process of the essential oil extraction facility as a raw material to extract essential oils from. The extracted aromatic plants are processed in composting silos and are fed back into the landscape in the form of organic compost to be utilized in the orchards and provided to local farmers. The pomace produced as a by-product of cider-making can be used as cattle feed and fertilizer by local farmers. Through the various production processes the building is able to feed back into the landscape providing it with a new form of resources and nutrients.



5.17_ Production processes and processing of agricultural crops (Author, 2014)

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ESSENTIAL OIL EXTRACTION FACILITY FUNCTIONAL AND SPATIAL REQUIREMENTS SHOWING THE ANTICIPATED SENSORY EXPERIENCE FOR EACH SPACE

SPACE:	DESCRIPTION:	FUNCTIONAL REQUIREMENTS:	SPATIAL REQUIREMENTS:	SENSORY EXPERIENCE:	SIZE:
WASHING AND DRYING SPACE  	Space where freshly harvested aromatic plants are WASHED AND CUT, reducing the raw material to the critical parts that essential oil can be extracted from. Some plants are distilled immediately upon harvest, some are partially dried and some may require to be completely dry before distillation, therefore a large DRYING SPACE is required.	WET SERVICES - large washing basins with running water. HEATING FOR DRYING PROCESS, requires direct controlled exposure to natural daylight for heating purposes. WARM CUPBOARDS with canvas shelves for drying sensitive plant species. LARGE CLEAR FLOOR SURFACE AREAS for drying large amounts of flowers, needs to be easily drained and washed LINK TO SERVICE ROUTE for deliveries	DOUBLE OR TRIPLE VOLUME SPACE CONTROLLED EXPOSURE TO NATURAL DAYLIGHT CONTROLLED NATURAL VENTILATION DIRECT CONNECTION TO HYDRO-PHONIC GREEN HOUSES MULTI-LEVEL SPACE CONNECTION TO PUBLIC SQUARE		WASHING, DRYING AND THRESHOLD SPACE: 180m² (3 levels)
HYDRO AND STEAM DISTILLATION SPACE 	HYDRO DISTILLATION: Raw plant material is immersed in water within the still and heated. Aromatic vapour rises into cooling chambers of alembic above and condenses into a liquid essence which is separated into floral water and essential oil. STEAM DISTILLATION: Raw material is placed within the still on a perforated grid above the steam inlet. Steam is generated in a satellite steam boiler and passes through the raw plant material to produce volatile fragrant essences which is collected through the condensation of the distilled Vapour.	WATER STORAGE TOWER INDUSTRIAL FLOOR easily drained and washed and able to carry heavy loads of industrial extraction equipment BOILER ROOM for supply of steam and hot water REFUSE AREA to store extracted aromatic plants LINK TO WASHING AND DRYING SPACE LINK TO ESSENTIAL OIL STORAGE SPACE LINK TO COMPOSTING SILOS CONNECTION TO WATER TREATMENT FACILITY	DOUBLE VOLUME SPACE NATURAL VENTILATION NATURAL DAYLIGHTING MEZZANINE LEVELS PUBLIC VIEWING SPACE/ROUTE SMELLING SPACE		DISTILLATION EXTRACTION SPACE: 160 m² SMELLING SPACE: 20 m² TOTAL: 180 m²
EXPRESSION EXTRACTION SPACE 	PELATRICE EXPRESSION: Citrus fruits are fed from a hopper into the abrasive shell of a machine whose surface scrapes their peels to release the essential is which is separated from unwanted waxes and solids by means of a separator and centrifuge. SEFUMATRICE EXPRESSION: A metallic chain is drawn by two horizontal ribbed rollers. Citrus peels are conveyed through these rollers and pressed and bent to release their oil that separated and purified.	WATER STORAGE TOWER INDUSTRIAL FLOOR easily drained and washed and able to carry heavy loads of industrial extraction equipment REFUSE AREA to store extracted citrus peels LINK TO CRUSHING AND PRESSING SPACE providing citrus peels LINK TO ESSENTIAL OIL STORAGE SPACE LINK TO COMPOSTING SILOS CONNECTION TO WATER TREATMENT FACILITY	SINGLE VOLUME SPACE NATURAL VENTILATION NATURAL DAYLIGHTING PUBLIC VIEWING SPACE/ROUTE SMELLING AND TASTING SPACE		EXPRESSION EXTRACTION SPACE: 100m² TASTING AND SMELLING SPACE: 40m² TOTAL: 140 m²
SOLVENT EXTRACTION SPACE 	MACERATION: Used for scents that are too volatile for distillation or are rapidly denatured by heat. Raw aromatic plant materials like petals are submerged into a solvent of molten fat to dissolve the essential oils. After 10 - 20 immersions "Concrete" is produced which is distilled with alcohol under low temperature and pressure to extract the concentrated essence as an "Absolute." ALCOHOL TINCTURING: Extraction of essential oils by submerging aromatic plants in perfumers alcohol (ethanol). CO2 EXTRACTION :Plant material is placed in a pressure vessel and liquefied gas is pumped through it that forces into the cell walls and separates the desired constituents rapidly.	WATER STORAGE TOWER INDUSTRIAL FLOOR easily drained and washed and able to carry heavy loads of industrial extraction equipment SOLVENT STORAGE SPACE PLANT ROOM housing cooling and heating units LINK TO WASHING AND DRYING SPACE LINK TO ESSENTIAL OIL STORAGE SPACE CONNECTION TO WATER TREATMENT FACILITY	DOUBLE VOLUME SPACE MECHANICAL AND NATURAL VENTILATION NATURAL DAYLIGHTING MEZZANINE LEVELS PUBLIC VIEWING SPACE/ROUTE SMELLING SPACE		SOLVENT EXTRACTION SPACE: 160 m² SMELLING SPACE: 20 m² TOTAL: 180 m²
ESSENTIAL OIL STORAGE AND RETAIL 	STORAGE AND RETAIL SPACE where extracted essential oils are stored, exhibited and sold to the public. RAW SCENT EXHIBITION SPACE where stored essential oils can be smelled Essential oils must be stored in a cool, dark space with no exposure to direct sunlight	STORAGE SHELVES CLIMATIC CONTROL DIRECT ACCESS FROM SERVICE ROUTE DIRECT ACCESS FROM PERFUMERS STUDIOS FORMS PART OF A PUBLIC ROUTE THROUGH THE SCARRED LANDSCAPE	SUBMERGED SPACE PUBLIC VIEWING ROUTE THROUGH SPACE SMELLING SPACES FOR RAW SCENT EXHIBITION INDIRECT DAYLIGHTING into essential oil storage spaces INSIDE OUTSIDE SPACE VARYING DEGREES OF ENCLOSURE		ESSEN-TAIL OIL RETAIL SPACE: 40 m² ESSENTIAL OIL STORAGE SPACE 80 m² TOTAL: 120 m²
PERFUMERS STUDIO 	Space where the master perfumer known as "THE NOSE" BLENDS AND COMBINES ESSENTIAL OILS to create new unique fragrances. An APPRENTICE TRAINING SPACE is combined with the perfumery to TRAIN SELECTED INDIVIDUALS IN THE ART AND ALCHEMY OF PERFUME MAKING.	PERFUMERS ORGAN PERFUMERS EQUIPMENT STORAGE SHELVES WRITING UP SPACE PACKING AND BOTTLING SPACE APPRENTICE TRAINING SPACE WET SERVICES LINK TO SERVICE ROUTE	CONTROLLED VENTILATION INDIRECT DAYLIGHTING SPACE WITH A VIEW MULTIPLE LEVELS ISOLATED PUBLIC VIEWING ROUTE THROUGH SPACE PUBLIC PRESENTATION SPACE EXTERIOR BALCONY		PERFUMERS STUDIO: 30 m² APPRENTICE TRAINING SPACE: 50 m² PACKING AND BOTTLING SPACE 30 m² TOTAL: 110 m²
SCENT LIBRARY AND RETAIL SPACE 	Scent library housing a VAST COLLECTION OF PERFUMES AND FRAGRANCES, BOOKS AND INFORMATION on the history of African and International perfumes, the art of perfume making, a botany index of aromatic plants and the uses and value aromatherapy. RETAIL SPACE where produced perfumes are sold to the public. Perfumes need to be stored in a cool, dark space with no exposure to direct sunlight.	PERFUME STORAGE SHELVES RETAIL COUNTER BOOK SHELVES INFORMAL READING SPACES MEDIA ROOM WET SERVICES LINK TO SERVICE ROUTE ACOUSTICALLY INSULATED SPACE - for reading and media room	NATURAL VENTILATION INDIRECT DAYLIGHTING - NO EXPOSURE TO DIRECT SUNLIGHT SMELLING AND TESTING SPACE		SCENT LIBRARY: 80 m² PERFUME RETAIL SPACE: 40 m² TOTAL: 120 m²
SCENT EXHIBITION 	A scent exhibition space where various perfumers can exhibit their fragrance ranges. A small cinema where scents are used to enhance the sensory experience of watching a film.	ACCESS CONTROL to the exhibition and cinema EXHIBITION STORAGE SPACE FOYER AND WAITING SPACE ACOUSTICALLY INSULATED SPACE - for scent cinema	CONTROLLED VENTILATION INDIRECT NATURAL DAYLIGHTING MULTIPLE LEVEL EXHIBITION SPACE SUBMERGED SPACE EXTERIOR VIEWING PLATFORM		SCENT EXHIBITION SPACE: 70 m² (3 levels) SCENT CINEMA: (75 seats) 125 m² TOTAL: 195 m² GRAND TOTAL: 1225 m²

5.18_ Table showing the functional requirements, spatial requirements and anticipated sensory experience of each space within the essential oil extraction facility. (Author, 2014)

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CIDER-MAKING FACILITY FUNCTIONAL AND SPATIAL REQUIREMENTS SHOWING THE ANTICIPATED SENSORY EXPERIENCE FOR EACH SPACE

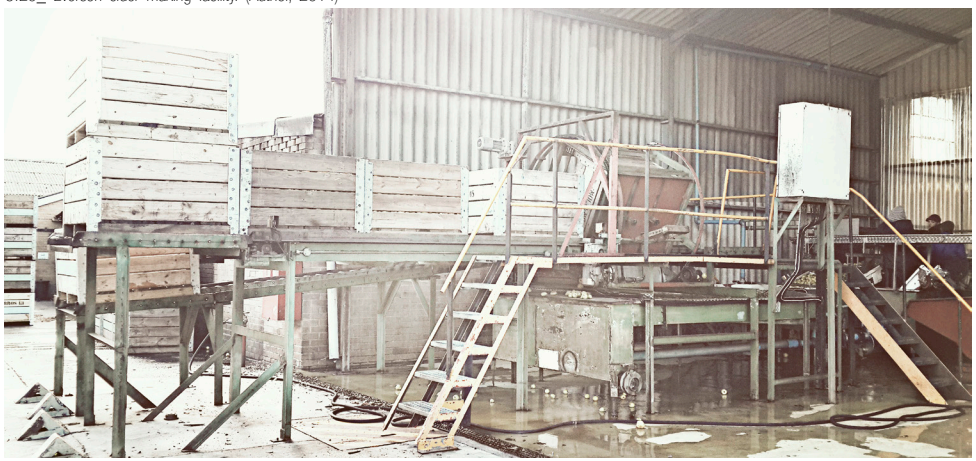
SPACE:	DESCRIPTION:	FUNCTIONAL REQUIREMENTS:	SPATIAL REQUIREMENTS:	SENSORY EXPERIENCE:	SIZE:
SWEATING SPACE 	Harvested fruit are spread out on wooden or concrete platform in a dark room to MATURE for about a week to ten days until a good firm squeeze leaves finger impressions on the fruit. This allows extra sugar and flavor components to form and softens the fruit making them easier to crush.	CONCRETE PLATFORM OR WOODEN SHELVES DIRECT CONNECTION TO HARVESTING ROUTE LINKED TO WASHING SPACE ACCESS RAMP OR SERVICE LIFT for large deliveries by truck after harvesting	SINGLE VOLUME SPACE DARK SPACE SUBMERGED/UNDERGROUND SPACE VERY LITTLE CONTROLLED INDIRECT NATURAL LIGHT CONTROLLED MECHANICAL VENTILATION		SWEATING SPACE: 80 m²
WASHING AND SORTING SPACE 	RIPENED FRUIT ARE WASHED to remove leaves, twigs, impurities and harmful bacteria, insects or spray residue. Rotten or moldy fruit are thrown out and brown spots are cut out of otherwise sound fruit. Apples, citrus fruit and peaches are sorted according to their cultivar.	WET SERVICES - WASHING BATHS CONSTANT FLOW OF WATER CONNECTION TO GREY WATER TREATMENT PLANT LINK TO SWEATING SPACE DIRECT CONNECTION TO HARVESTING ROUTE WATER USED FOR WASHING MUST BE MIN 15°C WARMER THAN FRUIT TEMPERATURE - SOLAR WATER HEATERS	OUTDOOR SPACE - SHADE CANOPY PUBLIC VIEWING SPACE/ROUTE allowing for controlled public access to space TASTING SPACE for tasting different varieties of apples, citrus fruit and peaches.		WASHING AND SORTING SPACE: 100 m²
CRUSHING AND PRESSING SPACE 	CRUSHING: Ripe fruit is fed into a hopper and transported with a conveyor to a "Scratcher" Mill consisting of 2 studded rollers turning in opposite directions crushing the fruit into a fine pulp. PRESSING: The pulp is poured into a bag that fits inside the slated POMACE container of a "tub press". As pressure is applied, the juice flows out. The pressed juice is funneled into stainless steel collecting vessels to avoid extended exposure to air and insects, after which it is pumped into blending containers in the Fermentation space and is now called "Must".	WET SERVICES INDUSTRIAL FLOOR easily drained and washed and able to carry heavy loads of industrial crushing and pressing equipment DRYING AREA to store presses pomace COMMON ROOM WASH AND SHOWER ROOM KITCHENETTE LINK TO WASHING AND SORTING SPACE LINK TO EXPRESSION EXTRACTION SPACE providing citrus peels CONNECTION TO WATER TREATMENT FACILITY PIPE CONNECTION FROM COLLECTING VESSELS TO BLENDING CONTAINERS IN FERMENTATION AND MATURATION SPACE	DOUBLE VOLUME SPACE housing crushing and pressing equipment NATURAL VENTILATION NATURAL DAYLIGHTING MEZZANINE LEVELS to allow multi-level access to solvent extraction tanks PUBLIC VIEWING SPACE/ROUTE allowing for controlled public access to space TASTING SPACE for tasting freshly pressed juice before fermentation CONNECTION TO FERMENTATION SPACE		CRUSHING AND PRESSING SPACE: 100m² TASTING SPACE: 50m² COMMON ROOM, WASH AND SHOWER ROOM, KITCHENETTE: 50 m² TOTAL: 200 m²
BLENDING, FERMENTATION MATURATION AND BOTTLING SPACE   	BLENDING: The apple juice "Must" is now blended with other fruit juices in the blending containers to achieve the desired flavor after which it is pumped into the fermentation vessels. FERMENTATION: SO^2 is added to the Must before fermentation takes place in order to kill bacteria and undesirable yeasts. Cultured yeasts are then added to the must to aid in the PRIMARY FERMENTATION PROCESS which takes place at a temperature of 4 - 16°C. Before all the sugars within the must is consumed by the yeast it is "racked" off (siphoned) into large maturation casks in the Maturation space for the 2nd part of the fermentation process. MATURATION: The large cider casks within this space is now completely filled with fermented "Must" from the fermentation space and sealed to exclude air. MALOLACTIC FERMENTATION now takes place which lasts for several months. This consumes the remaining sugar and carbonated the cider. The matured cider is then filtered to make it clear using a closed filter system which avoids exposing the cider to air. The cider is then BOTTLED, CAPPED and PASTEURIZED in a hot water bath (60°C) to avoid further fermentation.	WET SERVICES INDUSTRIAL FLOOR easily drained and washed and able to carry heavy loads of industrial fermentation vessels and blending containers BLENDING CONTAINERS FERMENTATION VESSELS VENTILATION TOWERS TO EXTRACT CO^2 RELEASED DURING FERMENTATION LARGE 546 LITER WOOD MATURATION CASKS CLOSED FILTER SYSTEM BOTTLING SPACE HOT WATER BATH - PASTEURIZATION BREWERS OFFICE CLIMATIC CONTROL - COOLING	DOUBLE VOLUME SPACES housing large fermentation vessels and large 546 l cider casks NATURAL AND MECHANICAL VENTILATION INDIRECT NATURAL DAYLIGHTING COLD PARTIALLY SUBMERGED AND UNDERGROUND SPACES MEZZANINE LEVELS to allow multi-level access to fermentation casks for adding cultured yeasts PUBLIC VIEWING SPACE/ROUTE allowing for controlled public access to space TASTING SPACE for tasting "Must" after Primary fermentation DIRECT CONNECTION TO TASTING RESTAURANT, RETAIL AND EVENT SPACE		BLENDING AND FERMENTATION SPACE: 100m² BREWERS OFFICE: 20 m² WORKERS REST AREA: 35 m² MATURATION SPACE: 80 m² FILTERING AND BOTTLING SPACE: 60 m² PASTEURIZATION: 20 m² TOTAL: 285 m²
TASTING RESTAURANT, RETAIL AND EVENT SPACE  	Large space where FORMAL CIDER TASTINGS AND EVENTS such as CIDER AND BEER FESTIVALS can be held. This space will also include a RESTAURANT that allows for FOOD PAIRINGS when tasting different ciders. Space is located on the edge of the break away line to provide a VIEW OF THE SCAR in the landscape. RETAIL SPACE where LOCALLY PRODUCED CIDER can be purchased.	BAR AREA INDOOR SEATING AND TABLES FOR VISITORS OUTDOOR SEATING AND TABLES FOR VISITORS KITCHEN AREA for preparation of meals during tastings PUBLIC ABLUTION RETAIL STORE WITH SHELVES AND PURCHASE POINT UNPROGRAMMED EVENT SPACE LINK TO MATURATION SPACE	SINGLE VOLUME SPACE DOUBLE STORY SPACE NATURAL VENTILATION NATURAL DAYLIGHTING MORE AND LESS INTIMATE SPACES PUBLIC VIEW POINT		TASTING Restaurant AND EVENT SPACE: 100 m² (2 levels) RETAIL SPACE STORAGE: 25 m² KITCHEN 60 m² PUBLIC W/C: 35 m² TOTAL: 220 m²
INFORMAL CIDER BAR AND DRINKING SPACE 	INFORMAL CIDER BAR AND DRINKING SPACE with a direct connection to the public square	BAR AREA INDOOR SEATING AND TABLES FOR VISITORS OUTDOOR SEATING AND TABLES FOR VISITORS PUBLIC ABLUTION RETAIL STORE WITH SHELVES AND PURCHASE POINT LINK TO MATURATION SPACE	SINGLE VOLUME SPACE NATURAL VENTILATION NATURAL DAYLIGHTING MORE AND LESS INTIMATE SPACES DIRECT CONNECTION WITH PUBLIC SQUARE		INFORMAL CIDER BAR: 100 m² PUBLIC W/C: 35 m² TOTAL: 135 m² GRAND TOTAL: 1020 m²

5.19_ Table showing the functional requirements, spatial requirements and anticipated sensory experience of each space within the cider-making facility. (Author, 2014)

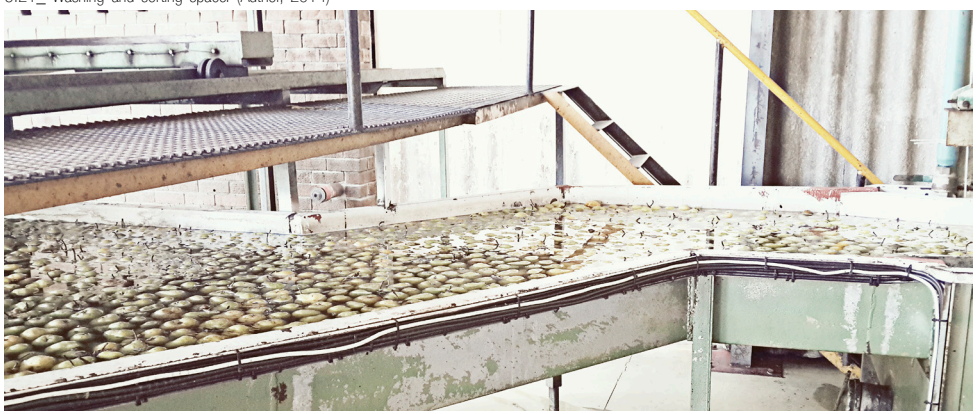
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5.20_ Everson cider making facility. (Author, 2014)



5.21_ Washing and sorting space. (Author, 2014)



5.22_ Washing and sorting equipment. (Author, 2014)

PRECEDENT STUDY/
EVERSON CIDER MAKING FACILITY:

The Everson cider making facility is located on the Malteno Brothers apple farm in Grabouw in the Western Cape. By conducting this precedent study a greater understanding of the mechanics of the cider-making process was achieved. Furthermore the study conducted elucidated the functional and spatial requirements of the washing and sorting space, the crushing and pressing space, the fermentation space and the maturation space.

The washing and sorting space exists as a covered outdoor space shown in **Figure 5.20**, to provide the forklifts delivering the fruits in crates ease of access. This space is located in close proximity to the crushing and pressing space, optimizing the flow of material by minimizing the distance the fruit has to travel. It also ensures that the fruit are kept as fresh as possible before being crushed and pressed. A purpose built machine conveys and washes the fruit while workers sort the washed fruit to achieve quality control. Acceptable fruit are sent to the crushing space while fruit of an inferior quality is separated to be used as compost or animal feed. As is evident in **Figures 5.21**, the floor surface of the washing and sorting space is to be very durable and waterproof as it has to carry the load of industrial machinery while being continually wet. This space is naturally lit and ventilated.

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5.23_ Steel water trough conveying the washed fruit into the crushing and pressing space (Author, 2014).



5.24_ Showing the "Scratcher" mill which crushes the fruit (Author, 2014)



5.25_ Showing how the "Scratcher" mill crushes the fruit to a fine pulp(Author, 2014)

The fruit is then conveyed by a water trough deeper into the building as shown in **Figure 5.23** towards the crushing and pressing space. Within this space the fruit is fed into a hopper from the washing channel and transported with a conveyor to a "Scratcher" Mill shown in **Figure 5.24** consisting of 2 studded rollers turning in opposite directions which crush the fruit into a fine pulp as shown in **Figure 5.25.** The pulp is then poured into a bag that fits inside the slated pomace container of a "tub press". As pressure is applied and the juice flows out as shown in **Figure 5.26.** The pressed juice is funneled into stainless steel collecting vessels to avoid extended exposure to air and insects, after which it is pumped into blending containers in the Fermentation space and is now called "Must". It is important to take notice of how wet the floors of the crushing and pressing space is due to fruit juice and water as shown in **Figure 5.23 and 5.24.** The floor surface of these spaces therefore have to be of a durable and water proof material such as polished concrete or industrial grade self leveling epoxy screed. These spaces also need to be provided with water reticulation channels (see **Figure 5.26**) which directs the fluids that build up within these spaces out of the building. The remaining fibers that are left over from the crushing and pressing process is known as pomace and can be used as animal feed.



5.26_ Showing the freshly pressed fruit juice being pumped into the stainless steel collecting vessel (Author, 2014).

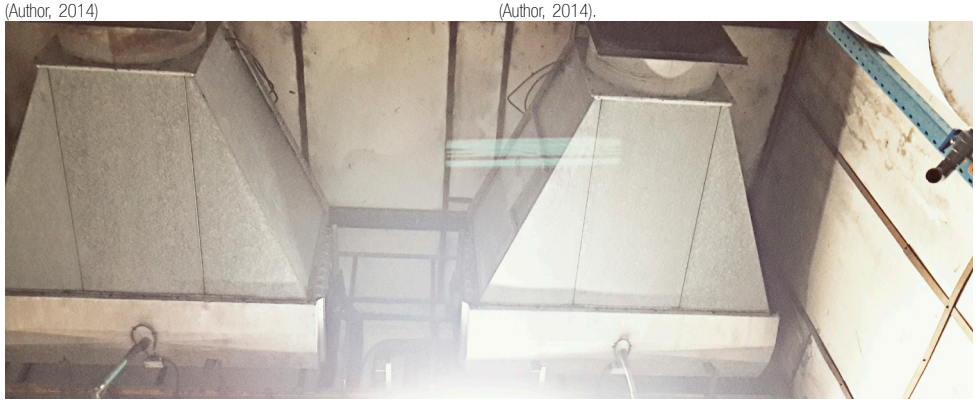
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5.27_ Fermentation space showing the plastic fermentation vessels. (Author, 2014)



5.28_ Fermentation space showing the wood cider maturation casks (Author, 2014).



5.29_ The large ventilation ducts within the fermentation and maturation spaces which removes the CO^2 released during the fermentation and maturation process (Author, 2014)

The pressed fruit juice or "Must" is now blended with other fruit juices in the temporary storage and blending containers to achieve the desired flavor after which it is pumped into stainless steel or plastic fermentation vessels within the fermentation space shown in **Figure 5.27.** This space exists as a multi-volume space consisting of a lightweight steel structural framework clad with galvanized steel sheeting externally and being well insulated internally. The floor surfaces are hard-wearing, durable and water proof as this space is also subjected to being continually wet. Well considered south facing windows reduces the need for extensive artificial lighting by bringing in soft indirect daylight. The space is also provided with a ventilation system that is able to remove the carbon dioxide released during fermentation. SO^2 is added to the Must before fermentation takes place in order to kill bacteria and undesirable yeasts. Cultured yeasts are then added to the must to aid in the primary fermentation that takes place at a temperature of 14 - 16°C. Before all the sugars within the must is consumed by the yeast it is "racked" off (siphoned) into the large maturation casks in the Maturation space for the 2nd part of the fermentation process.

The large cider casks within the maturation space shown in **Figure 5.28** are filled with fermented "Must" from the fermentation space and sealed to exclude air. The maturation space is a darker, cold space, being very well insulated and mechanically ventilated by means of two large ducts shown in **Figure 5.29.** Malolactic fermentation now takes place which lasts for several months. This consumes the remaining sugar and carbonates the cider. The matured cider is then filtered to make it clear using a closed filter system which avoids exposing the cider to air. The cider is then bottled, capped and pasteurized in a hot water bath (60°C) to avoid further fermentation.

The above investigation served as an invaluable resource not only to understand the spatial and functional requirements of the various production spaces but also to experience and get a feel for these spaces in order to ascertain their potential in eliciting sensory and spatial experience.

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CHAPTER 06 / DEVELOPING A NEW APPROACH TO INDUSTRIAL ARCHITECTURE _

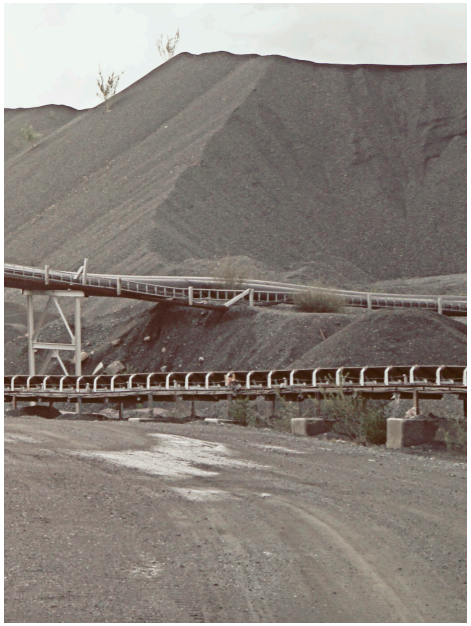
Architectural intentions, conceptual approach and design development

6.1_ (Author, 2014)

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6.2_ The industrial heritage (Author: 2014)



6.3_ The scarred landscape (Author: 2014)



6.4_ The natural landscape (Author: 2014)



6.5_ The open-pit excavation (Author: 2014)

DEVELOPING A NEW APPROACH TO INDUSTRIAL ARCHITECTURE/ 006

INTRODUCTION:

This section will elucidate the objective of proposing an additional solution to regenerate the post-industrial scarred environment through architecture. This will be achieved by investigating an alternative approach to industry which would establish a new interface between the public, the proposed productive industries and the industrial heritage. This new approach provides for a diversity of spatial and sensory experiences within the scarred environment at the mine. As discussed in Chapter 2, the focus area which was identified at the mine historically functioned as a waste-rock dumping site. This specific site contains four different physical conditions that need to be addressed by the proposed architecture. These physical conditions are:

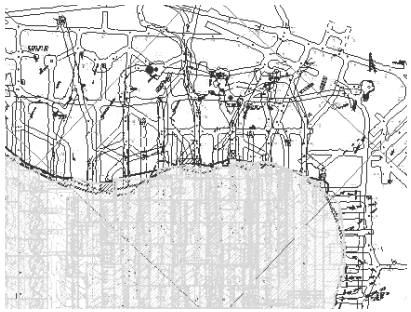
- The industrial heritage buildings
- The scarred landscape
- The adjacent natural landscape
- The open-pit excavation

This chapter establishes the architectural intentions in order to develop an appropriate conceptual approach. It demonstrates how existing conditions, patterns, relationships and principles can be manipulated and transformed to define a new approach to industrial architecture. A series of iterative conceptual models were used to develop the design. A process of layering conceptual plans and layouts was then employed to further investigate and refine the design in order to respond to the conceptual intentions and the functional requirements. This led to a three-dimensional modeling of the space which was systematically redefined and formed to establish an appropriate relationship with the landscape and the industrial context. The proposed architecture will attempt to reconcile public experience with the industrial heritage buildings, the scarred landscape, the natural landscape and the open-pit excavation to unveil the significance of the heritage and to encourage a re-imagining of its future.

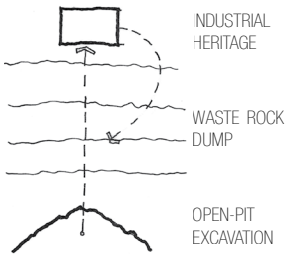
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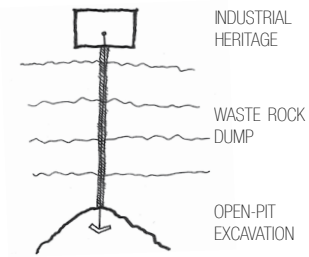
6.6_ The underground tunnels (Lincoln: 2011, edited by Author)



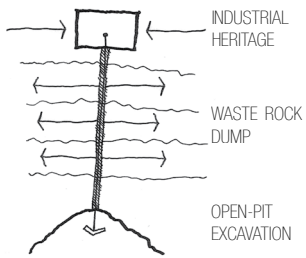
6.7_ Drawing of the underground tunnel networks (Lincoln: 2011)



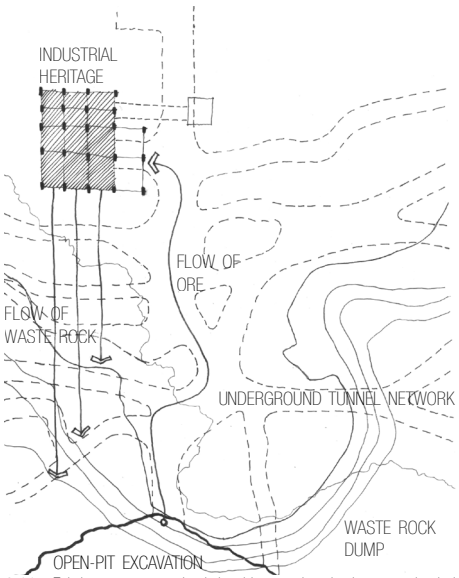
6.8_ The imperceptible connection between the industrial heritage and the open pit excavation (Author: 2014).



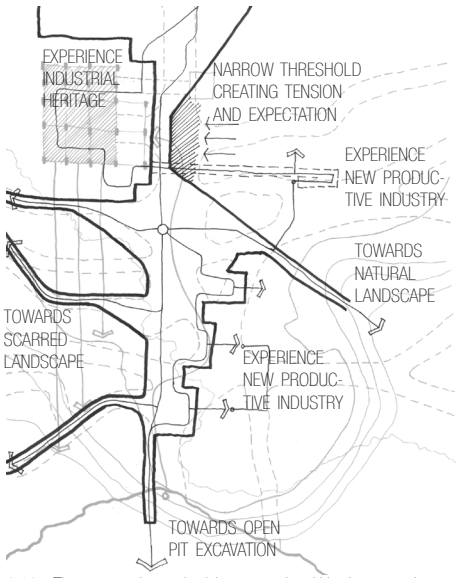
6.9_ Establishing a physical connection between the industrial heritage and the open pit excavation (Author: 2014).



6.10_ Establishing a new relationship with the scarred environment in order to understand its heritage (Author: 2014).



6.11_ Existing patterns and relationships on the site between the industrial heritage, the underground tunnel network, the open pit excavation and the waste rock dump (Author: 2014).



6.12_ The proposed experiential promenade within the scarred environment (Author: 2014).

ARCHITECTURAL INTENTIONS /

Three primary architectural intentions were identified in response to the issues discussed in Chapter 01 to inform a new approach to industrial architecture. The following section will serve to explain and illustrate how these intentions informed the methodology and development of the architectural design.

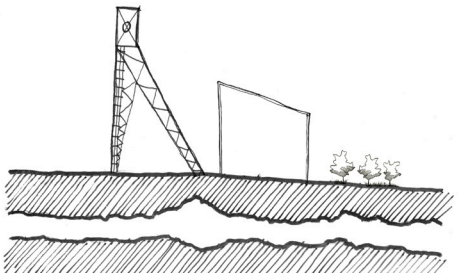
ARCHITECTURAL INTENTION 01:
CREATING A SENSORY AND EXPERIENTIAL PROMENADE WITHIN THE SCARRED ENVIRONMENT

Architecture that engages our senses and shapes our experience draws us near, rewards our repeated encounter and only reveals its full character incrementally, over time (McCarter cited in Pallasmaa 2012: 5).

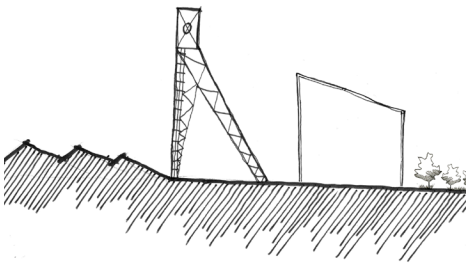
The limited and homogeneous environments created by current approaches to industry can be alleviated by proposing a diversity of sensory and experiential spaces within the post-industrial scarred environment. These spaces are conducive to the formation of new memories and allow for a meaningful reflection on the past. This spatial diversity is more resilient in that it allows for a multiplicity of experiences and interpretations on visiting the site, while simultaneously re-establishing a connection to its sense of place. Currently an imperceptible connection exists between the industrial heritage buildings and the open-pit excavation (see **Figure 6.8**). This hidden or concealed connection consists of a network of underground tunnels, as shown in **Figures 6.6, 6.7 and 6.11**, which function as circulation networks for the transportation of raw material and machinery. It is therefore imperative for this connection to be re-established and made visible in order to strengthen public understanding and interpretation of the site (**see Figure 6.10**). An experiential promenade is proposed through the scarred landscape that establishes this new physical connection between the industrial heritage buildings, the new proposed industry and the open-pit excavation (**see Figure 6.12**). This promenade extends into the scarred landscape in the form of various routes which align themselves with the position of the underground tunnel networks, shown in **Figure 6.11**, to acknowledge and reflect their existence. Along this promenade different spaces allow the public to engage with the post-industrial scarred environment and the new industries.

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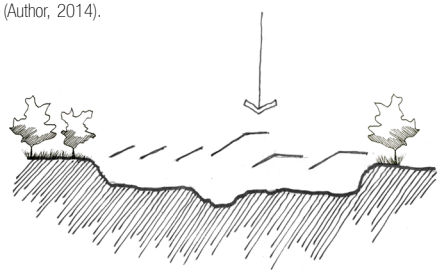
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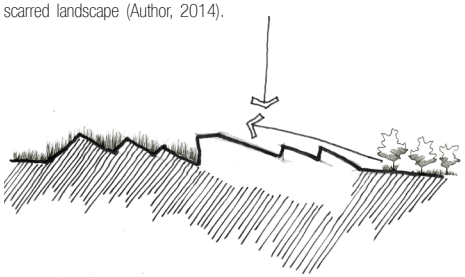
6.13 _ Domination and control of the landscape by historical industry (Author, 2014).



6.14 _ Degradation of the landscape by historical industry, creating a scarred landscape (Author, 2014).



6.15 _ Subterranean productive spaces establish a new relationship with the surrounding landscape (Author, 2014).

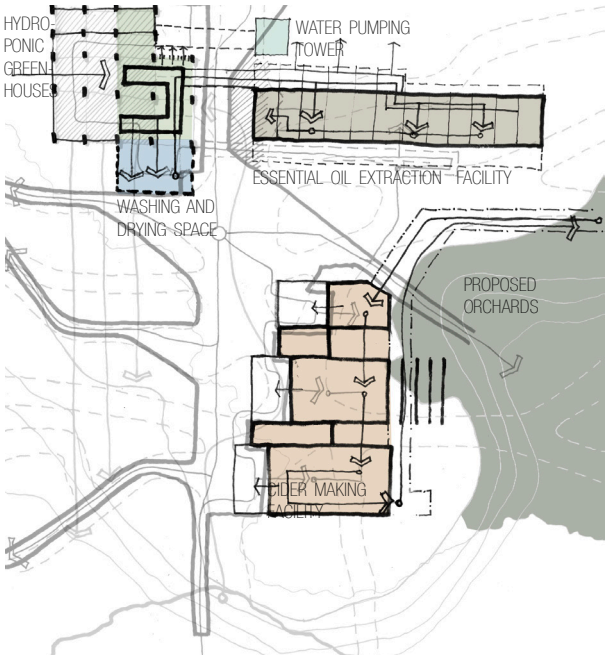


6.16 _ Industrial architecture as a continuation of the landscape collapses the boundary between natural and built fabric (Author, 2014).

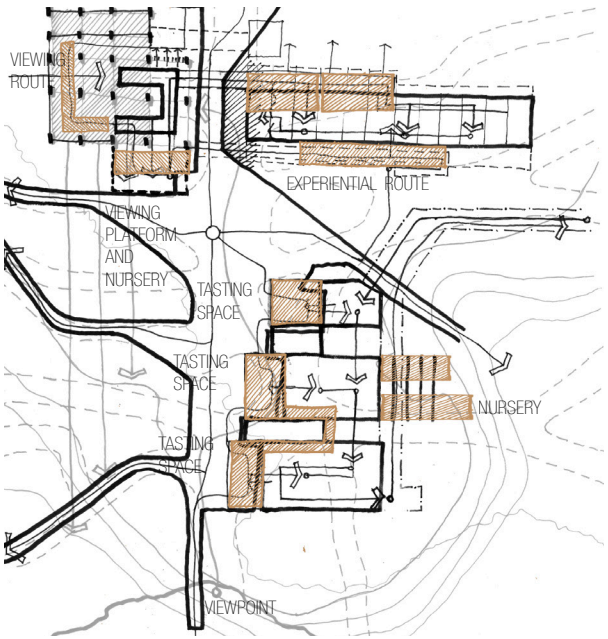
ARCHITECTURAL INTENTION 02:
DEFINING A NEW RELATIONSHIP BETWEEN PRODUCTIVE INDUSTRY AND THE SCARRED ENVIRONMENT

The scarred environment that will remain after the decommissioning of the Cullinan Diamond Mine will consist of the industrial heritage in the form of existing buildings or structures, and the scarred landscape in the form of a waste-rock dumping site, the surrounding kimberlite tailings, and the open-pit excavation. The proposed architecture will aim to establish a new mutualistic relationship with the scarred landscape (see **Figures 6.15 and 6.16**) in contrast with the historical relationship of domination and degradation of the landscape by industry (see **Figures 6.13 and 6.14**). The site under investigation (which is the waste-rock dumping site) can effectively be excavated with potential spaces of thermal mass, which are ideal for subterranean production processes which require a controlled internal environment. These subterranean productive spaces establish a new relationship with the surrounding landscape, as shown in **Figure 6.15.** The adjacent natural landscape will be re-established as a productive landscape by means of orchards that provide fruit for the making of cider. By developing a new typology for industrial architecture that gradually slopes out of the natural landscape, the boundary between natural and built fabric is collapsed. This allows the architecture to read as a continuation of the natural landscape, as shown in **Figure 6.16.** By identifying the potential that the scarred environment provides, the placement, character and spatial qualities of the productive spaces can be informed and a new relationship between these productive processes and their surroundings can be established.

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6.17 _ New productive industries are established within the scarred environment creating new relationships with their surroundings (Author, 2014).



6.18 _ Where the layers of experience and production overlap a new experiential public interface is established between the public, production and the industrial heritage. (Author, 2014).

A section of the existing crusher building will be adaptively re-used as a hydroponic greenhouse for essential oil crops, shown in light green in **Figure 6.17.** This informed the position of the washing and drying space, shown in dark blue in **Figure 6.17**, as an addition attached to the adaptively re-used section of the existing crusher building. Furthermore, the existing water-pumping tower, shown in light blue in **Figure 6.17**, will be adaptively re-used as the infrastructure that provides the new productive industries with a constant supply of fresh water. The linear nature of the production process as discussed in Chapter 5 informed the layout of the production spaces of the cider-making facility and the essential oil extraction facility. The position of the washing and drying space and the adaptively re-used water-pumping tower informed the placement of the essential oil extraction facility shown in light brown in **Figure 6.17.** This placement allows for a direct connection to the washing and drying space where essential oil crops are prepared for extraction, and ensures a close proximity to the water-pumping tower which provides water for distillation extraction. The position of the productive landscape, in the form of orchards shown in dark green in **Figure 6.17**, and the linear nature of the production process influenced the position of the cider-making facility, as shown in orange in **Figure 6.17.**

ARCHITECTURAL INTENTION 03: PROVIDING AN EXPERIENTIAL INTERFACE BETWEEN PUBLIC EXPERIENCE AND INDUSTRIAL PRODUCTION

Where the layers of experience and production overlap, as shown in **Figure 6.18**, potential for programmatic synergy can be identified. Possibilities of cross influence create potential for a new experiential public interface. This experiential interface allows the public to understand and interact with the industrial heritage and the proposed productive industry, creating an awareness of the impact of industry on the natural environment, while proposing an alternative mutualistic future relationship that could exist between industry and the scarred environment. The program of these spaces within the proposed architecture will include experiential viewing routes and platforms, various tasting spaces at different points of the production process, a bar and restaurant, an essential oil exhibition and retail space, a nursery, and a viewing point over the open-pit excavation.

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6.19 _ Showing the heavy base and lightweight skin of the existing typology of the industrial heritage at the Cullinan mine (Author, 2014).

LIGHTWEIGHT TECTONIC SKIN

HEAVY, SOLID BASE

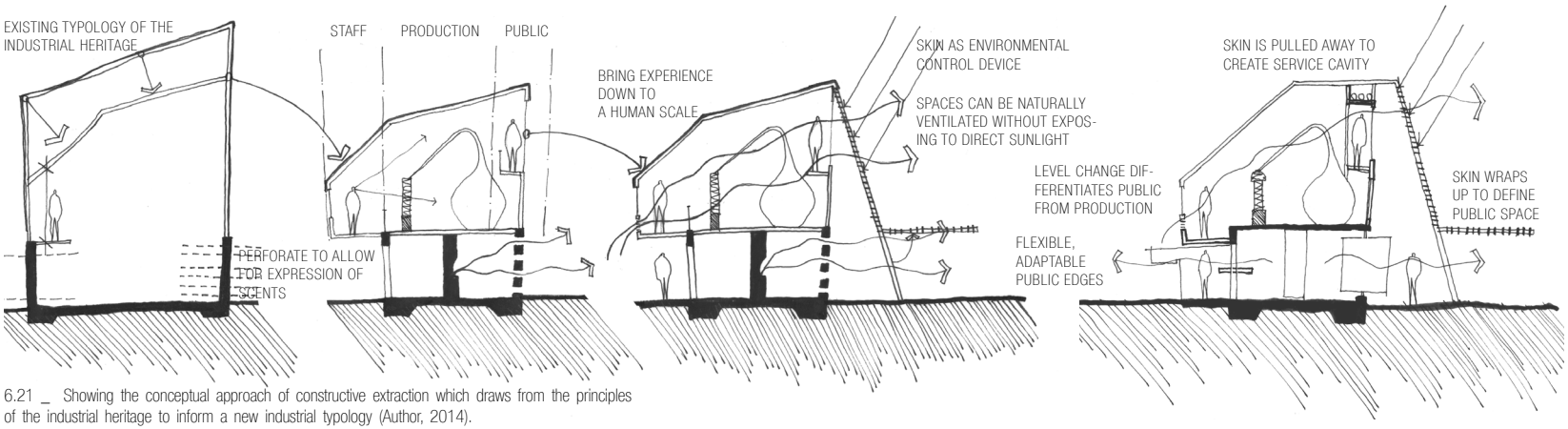
6.20 _ Legend (Author, 2014).

CONCEPTUAL APPROACH /

The existing mining industry is associated with the destruction and disruption of the natural environment to create a scarred landscape through the extraction of non-renewable natural resources. In response to this, the conceptual approach intends to invert this destructive extraction by proposing a constructive extraction and reinsertion as a new approach to inform industrial architecture. This involves establishing an alternative relationship between industry, the public and the scarred landscape, which gives back and regenerates the post-industrial scarred environment by adding purpose, value and meaning.

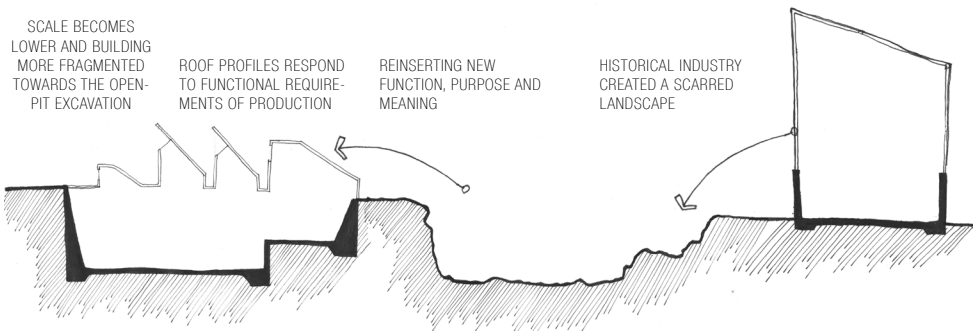
CONSTRUCTIVE EXTRACTION:

By using the analogy of extraction – which means to obtain from, deduce or construe – the concept of constructive extraction draws from existing patterns, relationships and the principles of the industrial heritage to inform a new architectural typology (see **Figure 6.21**). When extracting essential oils from plant material through distillation, the structure of the plant cells that contain the oil is manipulated and transformed to release a new substance in the form of an essence or oil. Analogous to this process, the existing industrial typology, having a heavy base and a light tectonic wall and roof structure (see **Figure 6.19**), is manipulated and transformed to respond to the spatial and functional requirements of the new industry. Furthermore, the spatial experience is brought down to a human scale at the points of public interaction with the production processes (see **Figure 6.21**). The metaphor of extraction is therefore used as a conceptual approach which informs how the new industrial typology is derived. The functional requirements of the production processes, as discussed in Chapter 5, will also play a significant role in informing the spatial quality of the architecture and will therefore influence public experience of these productive spaces. The primary spatial requirement of the essential oil extraction facility, where significant temperatures and steam is built up during the distillation process, is that it must be possible to ventilate it effectively. This informs the typology of a double envelope, with openable glazing wrapped in a lightweight skin that functions as an environmental control device. This allows the extraction spaces to open up completely and ventilate during distillation, while preventing overheating by direct sunlight.

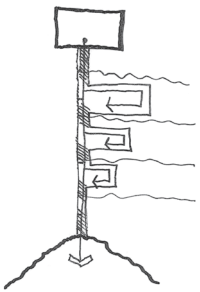


6.21 _ Showing the conceptual approach of constructive extraction which draws from the principles of the industrial heritage to inform a new industrial typology (Author, 2014).

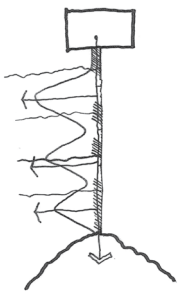
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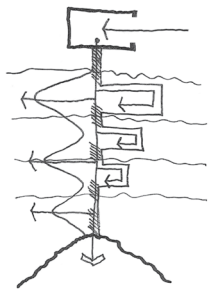
6.22 _ Showing the conceptual approach of reinsertion which places new value and meaning back into the scarred landscape created by the mine (Author, 2014).



6.23 _ Creating contained productive and public spaces within the natural landscape along a central axis (Author, 2014).



6.24 _ A series public routes guide visitors into the scarred landscape initiating experience and understanding of the post-industrial scarred environment (Author, 2014).



6.25 _ An experiential public interface is created between the public, the industrial heritage, the new productive industry, the scarred landscape and the natural landscape (Author, 2014).

REINSERTION:

By reinserting function and public experience into the scarred landscape, as shown in **Figure 6.22**, new value and meaning can be created within it. The primary spatial requirement of the cider-making facility is to achieve a controlled internal temperature to allow for the fermentation and maturation of the cider at an ambient temperature of 14° C. This requirement informs the design of subterranean production spaces with sufficient thermal mass by excavating these at various depths so that specific internal temperatures can be maintained more effectively. The cider-making facility is therefore envisioned as a series of contained production and public spaces in the landscape, placed along the central axis which connects the industrial heritage with the open-pit excavation (see **Figure 6.23**). A series of experiential routes will be excavated into the scarred landscape, as shown in **Figure 6.24**, in alignment with the position of the underground tunnel networks. These routes will guide visitors into the scarred environment, allowing for experience, interpretation and understanding.

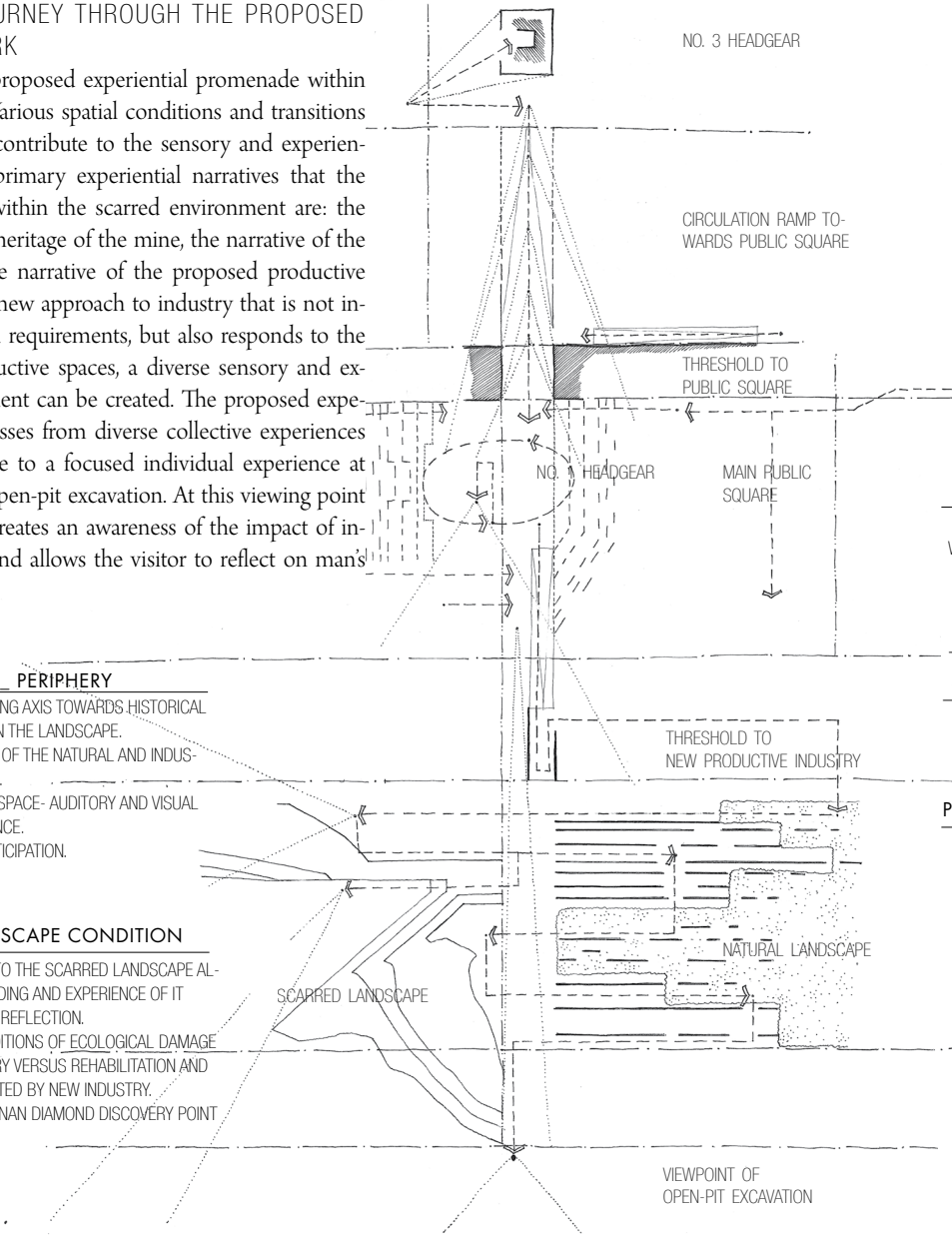
By utilizing the conceptual approach of constructive extraction and reinsertion, a new approach to industrial architecture can be informed which redefines its relationship with its environment, responds to the functional requirements of production, and allows a diversity of spatial and sensory public experiences. An experiential interface is created between the public, the industrial heritage, the new productive industry, the scarred landscape, and the natural landscape (**Figure 6.25**) by reconciling experience, production and heritage. This allows for an understanding of and engagement with the post-industrial scarred environment and encourages a reflection on the past.

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EXPERIENTIAL PROMENADE:
AN EXPERIENTIAL JOURNEY THROUGH THE PROPOSED PRECINCT FRAMEWORK

Figure 6.26 shows the proposed experiential promenade within the precinct framework. Various spatial conditions and transitions were identified that may contribute to the sensory and experiential narrative. The three primary experiential narratives that the architecture will explore within the scarred environment are: the narrative of the industrial heritage of the mine, the narrative of the scarred landscape, and the narrative of the proposed productive industry. By developing a new approach to industry that is not informed only by functional requirements, but also responds to the qualitative nature of productive spaces, a diverse sensory and experiential spatial environment can be created. The proposed experiential promenade progresses from diverse collective experiences on the main public square to a focused individual experience at the viewing point of the open-pit excavation. At this viewing point a heightened experience creates an awareness of the impact of industry on the landscape and allows the visitor to reflect on man's exploitation of nature.



ARRIVAL AND ORIENTATION CONDITION
_VISUAL: CONNECTION TO HEADGEARS AS ORIENTATION POINTS
OPEN UNRESTRICTED VIEWS
_TACTILE: EXPOSED TO THE ELEMENTS (UNENCLOSED)
_ AUDITORY: UNCONTAINED
_ARRIVAL POINT - GATHERING SPACE.

IMMERSION CONDITION
_GRADUAL DESCENT INTO LANDSCAPE.
_VISUAL: VIEW GRADUALLY BECOMES MORE CONTAINED AND DIRECTED.
_TACTILE: GRADUAL EXPERIENCE OF DESCENDING.
_AUDITORY: GRADUALLY BECOMES MORE ISOLATED FROM SURROUNDING SOUNDS AND NOISE.
_TRANSITIONAL SPACE.

TRANSITION 01_ GATEWAY
HORIZONTAL AND VERTICAL ENCLOSURE.
_STRONG VISUAL, TACTILE AND AUDITORY SENSE OF BEING CONTAINED AND ENCLOSED.
_DARK TRANSITIONAL SPACE.
_ECHOING CREATES SELF AWARENESS.

CONTAINED CONDITION
_VISUALLY CONTAINED BECOMING GRADUALLY LESS CONTAINED WHEN MOVING OUT OF SPACE OR ASCENDING HIGHER UNTIL VIEW IS RELEASED.
_CONFRONTED WITH INDUSTRIAL SCALE- SENSE OF AWE AND INTIMIDATING.
_SOUND IS CONTAINED/ISOLATED FROM NOISE OF SURROUNDING ENVIRONMENT.
_TACTILE - CHANGE IN SURFACE TEXTURE WHEN LEAVING AXIS AND SHADE CAST BY INDUSTRIAL STRUCTURES.
_SPACE OF REPOSE, REST LINGERING.

TRANSITION 02_ PERIPHERY
_ STRONG VISUAL CONNECTION ALONG AXIS TOWARDS HISTORICAL HEADGEAR AND SCAR IN THE LANDSCAPE.
_ ASCENDING TOWARDS THE EDGE OF THE NATURAL AND INDUSTRIAL.
_MOVING FROM AN UNCONTAINED SPACE- AUDITORY AND VISUAL EXPERIENCE.
_CREATING ANTICIPATION.

PRODUCTIVE NATURAL LANDSCAPE CONDITION
_CONCEALED UNDERGROUND TUNNEL NETWORK
_ORCHARDS PROVIDE A DIVERSITY OF SPATIAL AND SENSORY EXPERIENCE AS A NATURAL ENVIRONMENT.
ARCHITECTURE MOVES FROM A COLLECTIVE DIVERSE EXPERIENCE TO A FOCUSED INDIVIDUAL EXPERIENCE
PRODUCTION SPACES ESTABLISHES A NEW RELATIONSHIP WITH THE LANDSCAPE

VISIBLE SCARRED LANDSCAPE CONDITION
SUBMERGED PUBLIC ROUTES INTO THE SCARRED LANDSCAPE ALLOWS FOR AN UNDERSTANDING AND EXPERIENCE OF IT
_ SPACE OF REFLECTION.
_SHOWING CONTRASTING CONDITIONS OF ECOLOGICAL DAMAGE CAUSED BY PREVIOUS INDUSTRY VERSUS REHABILITATION AND REMEDIATION FACILITATED BY NEW INDUSTRY.
_ VISUAL CONNECTION TO CULLINAN DIAMOND DISCOVERY POINT

ENGAGING WITH THE SCARRED CONDITION
_AWE INSPIRING SENSORY AND SPATIAL EXPERIENCE.
_EXPOSED SPATIAL CONDITION.
_AUDITORY AND TACTILE EXPOSURE TO SURROUNDINGS.
_VIEW IS RELEASED INTO THE SCAR IN THE LANDSCAPE.
FOCUSED INDIVIDUAL EXPERIENCE

6.26 _ Experiential promenade showing the conditions and transitions within the proposed precinct framework on the site (Author, 2014).

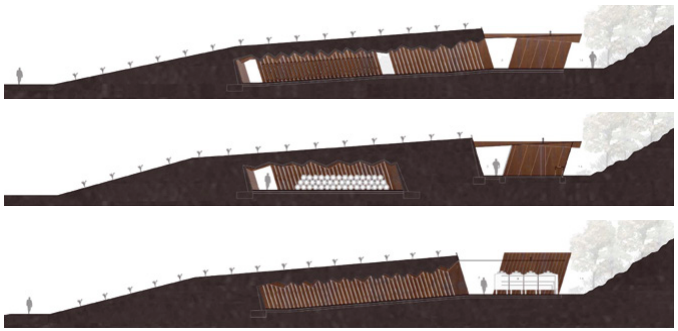
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6.27 _ Public route descending towards the subterranean production spaces creating an immersion into the landscape (Author, 2014).



6.28 _ Showing the architecture as a promenade of negative and positive spaces (Author, 2014).



6.29 _ Sections showing the building and production spaces as an insertion into the landscape (Author, 2014).

DESIGN PRECEDENT/
BELL-ILOC WINERY (2007)

Architects: RCR Arquitectes
Location: Palamós, Girona, Spain
Project Architects: RCR Rafael Aranda, Carme Pigem, Ramón Vilalta Arquitectes
Project Area: 981.0 m2

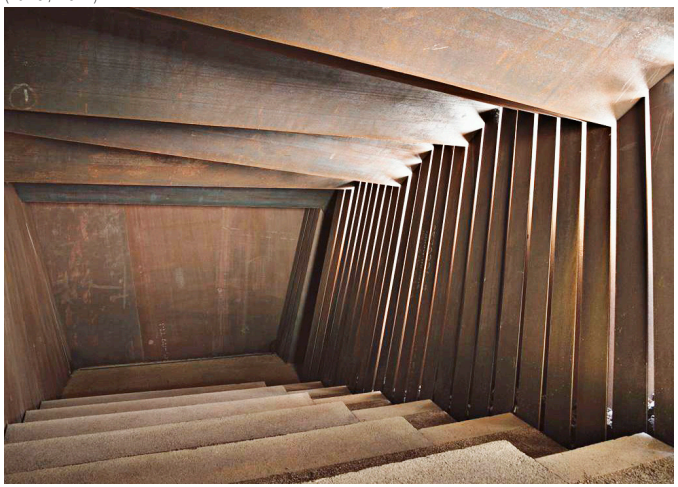
The Bell-Iloc winery sits embedded within the landscape, a few kilometers from Costa Brava in Spain. The relevance of this project as a design precedent lies in the fact that the architecture, which has an industrial programme is developed as a sensory and experiential promenade while establishing a new relationship with the surrounding natural landscape. The building is inserted into the landscape as shown in **Figure 6.29** in such a way that it responds to the contours of the site and the carefully considered vistas into the landscape. William (2010: 47) describes the project as being a middle ground between architecture, an abstract sculpture and landscape design.

The success of the architecture lies in the fact that it is designed as a promenade of negative and positive spaces (see **Figure 6.28**), varying in intensity and sensory experience. The various spaces engage the senses as you gradually descend along the route shown in **Figure 6.27** towards a series of subterranean spaces while immersing yourself in the landscape. This concept of an experiential promenade will be explored within the dissertation as a means of organizing different spatial and sensory experiences. The architects of Bell-Iloc transformed the programme into a ceremonial sequence, amalgamating sensory experience with production spaces. (William 2010: 47) This approach will be employed within the dissertation in order to inform a new experiential interface between the public and production.

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6.30 _ Showing the interplay between light and shadow within the stepped theatre space (Author, 2014).

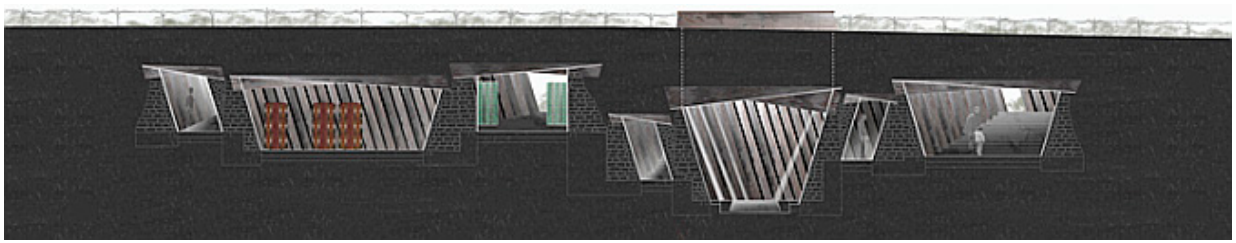


6.31 _ Showing the vertically positioned corten steel plates which allows natural daylight to enter (Author, 2014).

The spatial progression within the Bell-Iloc winery is described by William (2010: 47, 51) as follows:

"You descent to the lower level by means of a gentle slope, wandering past the stainless steel vats where the wine is fermented, then entering a subterranean world of semi-darkness through steel doors. The wine is stored in a space that is both cool and dark and you move through these silent cellars of suspended barrels and bottles in racks, accompanied only by the crunch of gravel underfoot and the senses of touch and smell...You then descent by means of a labyrinthine path to a wine-tasting room - a haunting space which seems to be set aside for ritual. This is followed by another place of assembly, a small stepped theatre for informal concerts...You reemerge, blinking in the day light, somehow transformed by this journey into the underworld."

The public circulation route within the Bell-Iloc winery can be seen as a steel valley descending into the landscape which is achieved by means of diagonally positioned corten steel plates that sculpts the earth while allowing natural light to enter into the building as shown in **Figure 6.31.** These steel flat plates are reminiscent of the wooden beams used to support walls in a mine. Spatial fluidity and a variety of ambiances are successfully created by repeating the language of the corten slats at various angles as shown in the sections in **Figure 6.32.** With the slats, the structure breathes and light filters into the building. It also allows for dynamic interplay between light and shadows (see **Figure 6.30**). The use of slivers of light between the slats gives the spaces the illusion of dissolving into the underground shadows. (William 2010: 47, 51)

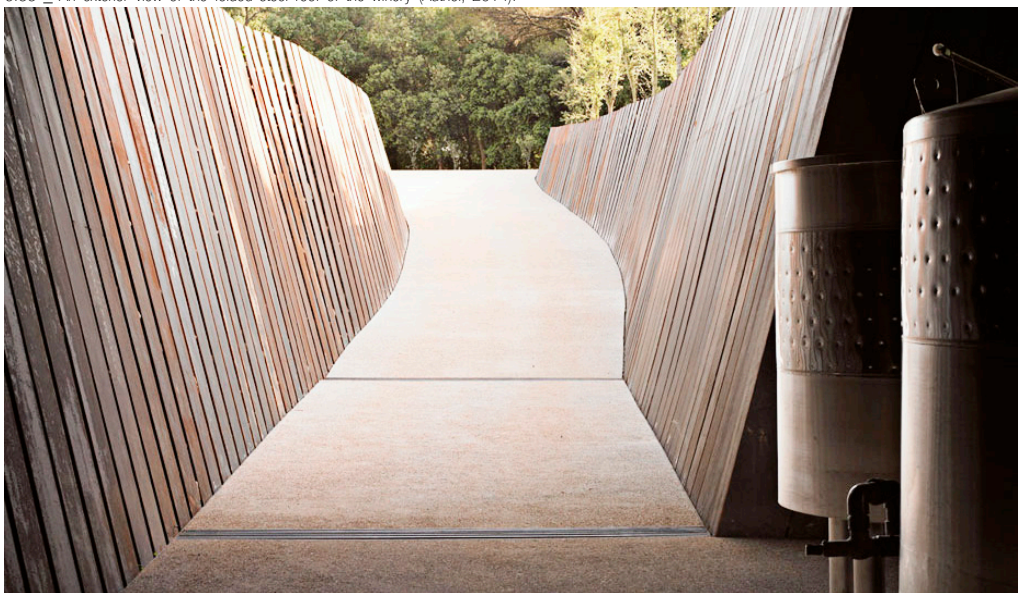


6.32 _ A series of sections showing the various spaces within the building with the vertical corten plates at different angles. (Author, 2014).

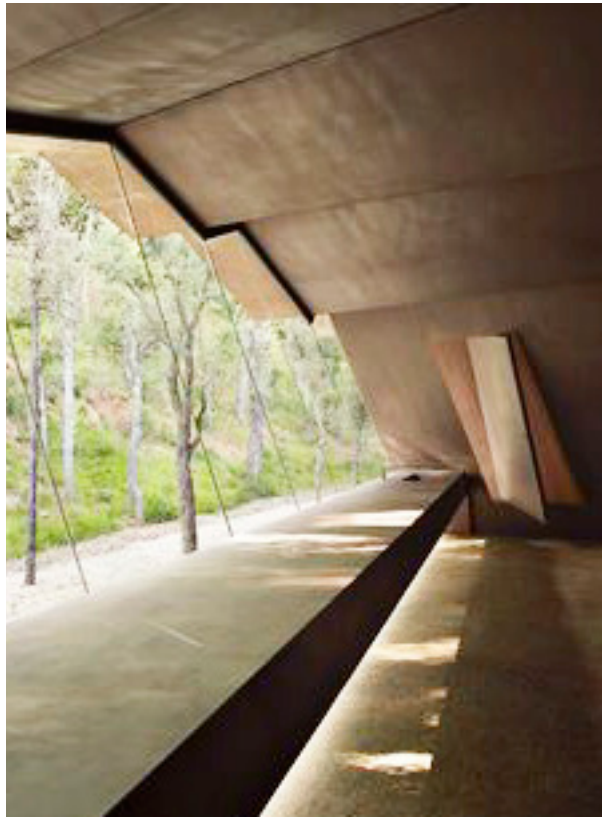
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6.33 _ An exterior view of the folded steel roof of the winery (Author, 2014).



6.34 _ Showing the production spaces along the public promenade (Author, 2014).



6.35 _ The building opens up to allow for vistas into the landscape (Author, 2014).



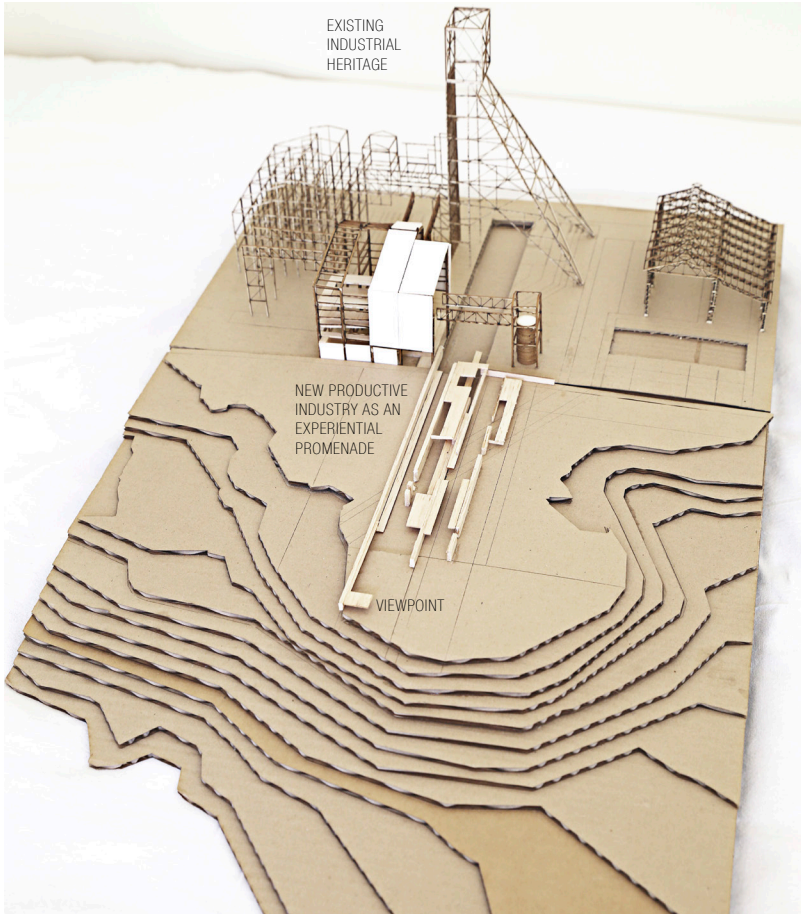
6.36 _ Exterior view of the folded steel roof and glazed facade (Author, 2014).

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DESIGN DEVELOPMENT/

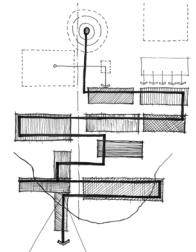
CONCEPTUAL MODEL 1:



6.37 _ Conceptual model 01 (Author, March, 2014).

MODEL 01: This model explored the notion of the proposed industry as an experiential promenade that reconnects the industrial heritage with the open-pit excavation. It was a purely intuitive and emotional response to the site. The model also investigated how various degrees of enclosure, achieved by means of alternating horizontal and vertical planes, could create a variety of spatial experiences along the axis towards the open-pit excavation. It became clear that the scale of the proposed architecture lacked an appropriate response to the existing industrial heritage on the site. This iteration did also not engage sufficiently with the natural landscape or the scarred landscape, as it became too restricted by the central axis.

CONCEPTUAL MODEL 2:



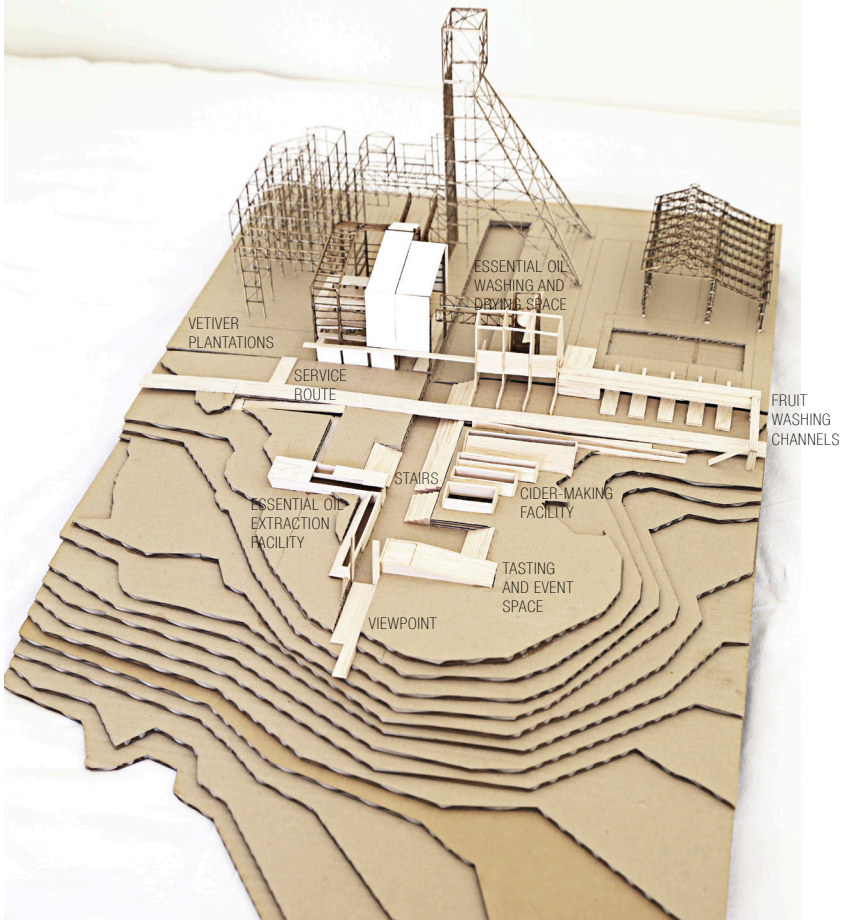
6.28 _ Initial conceptual diagram (Author, 2014).

6.38 _ Conceptual model 02 (Author, April, 2014).

MODEL 02: The architecture started to engage more with the natural and the scarred environment by means of spaces which extended into the landscape. The proposed buildings started to define various public spaces between them. A stronger edge was established towards the industrial heritage by increasing the height of the proposed buildings. The concept of this iteration was to establish a public spine or route which originates within a contained environment, is intersected by a series of sensory and experiential spaces, and is then released into the scarred landscape at the viewing point (see **Figure 2.38**). The proposed building, however, became too vast and disconnected while overwhelming the industrial heritage buildings.

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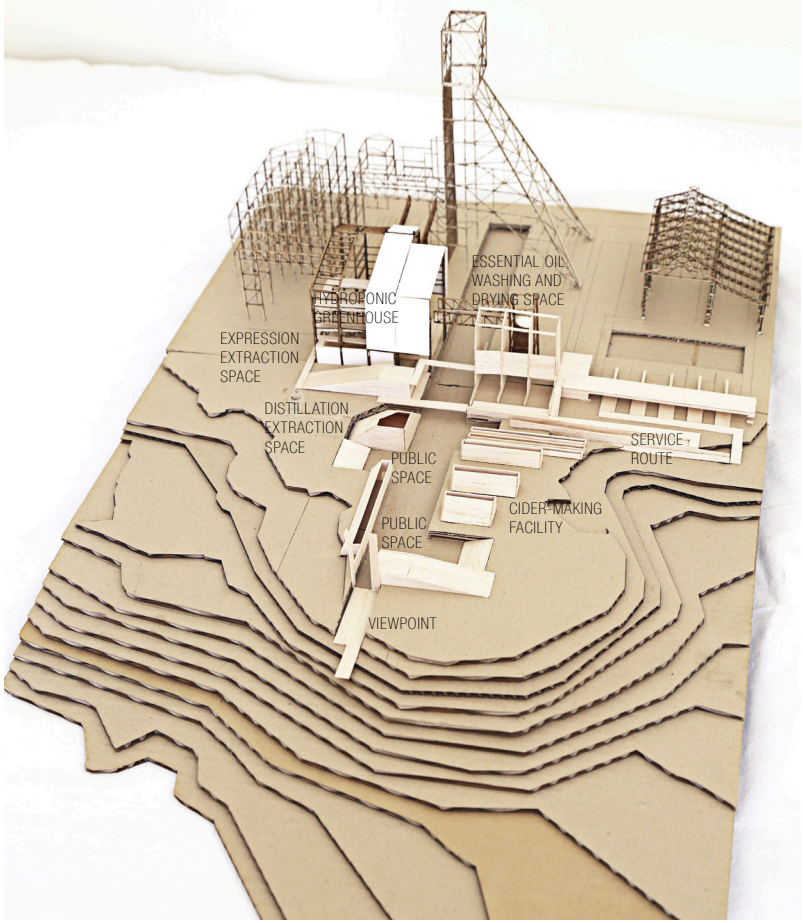
CONCEPTUAL MODEL 3:



6.39 _ Conceptual model 03 (Author, April, 2014).

MODEL 03: The production spaces of the cider-making facility were organized to be more compact and contained within one building. The linear nature of the various production processes informed the layout of these spaces along the axis. The cider-making facility was envisioned as a series of submerged spaces with roofs that extrude out of the landscape to bring in natural light from above. The fruit-washing space was developed as a series of channels with an overhead canopy. A tower typology was proposed for the essential oil washing and drying space to allow for natural drying and ventilation. A typology was developed for the tasting and events space that gradually slopes out of the landscape. The essential oil extraction facility was placed in the scarred landscape in close proximity to the Vetiver plantations. A series of stairs were designed to frame the view along the experiential promenade towards the viewing point.

CONCEPTUAL MODEL 4:



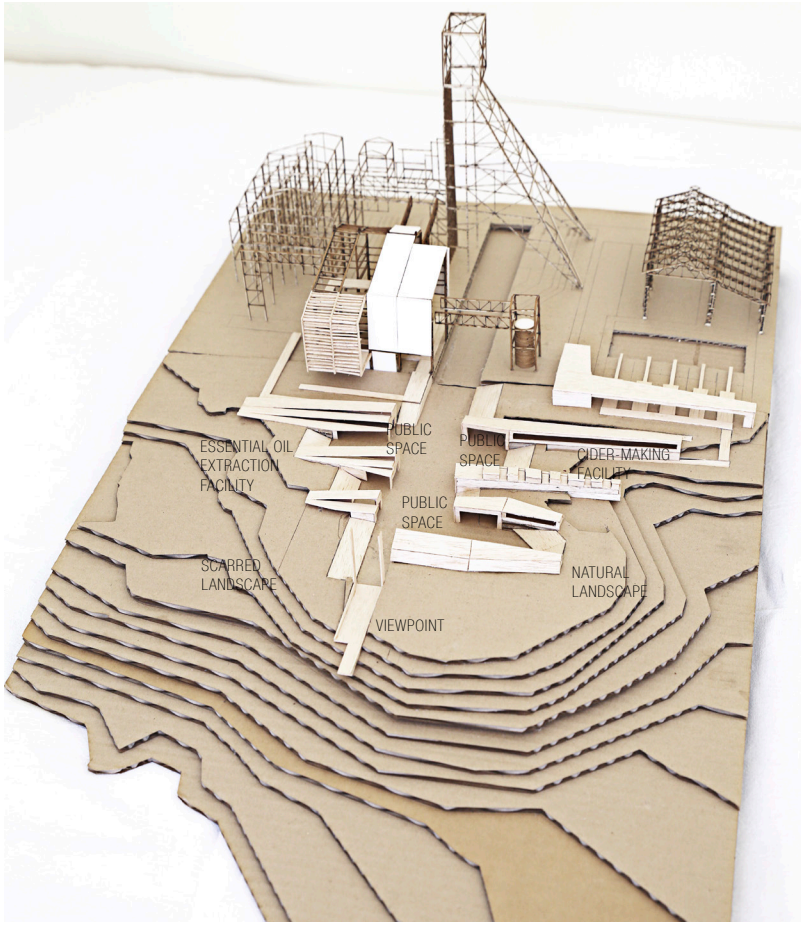
6.40 _ Conceptual model 04 (Author, April, 2014).

MODEL 04: Various typologies were explored for the production spaces of the essential oil extraction facility. A sculptural typology was explored for the distillation extraction space. The typology of the expression extraction space was designed to function as a connection between the hydroponic greenhouses and the washing and drying space. The layout of service routes that connect various production spaces was reorganized. The roofs of the cider-making facility were simplified and redesigned to bring in light, depending on the specific requirements of the production processes. Although the intent of this iteration was to refine the organization of the different production spaces, the typologies became too varied and separated with no relationship between them. The public spaces between the buildings needed to be refined. The experiential route needed further definition.

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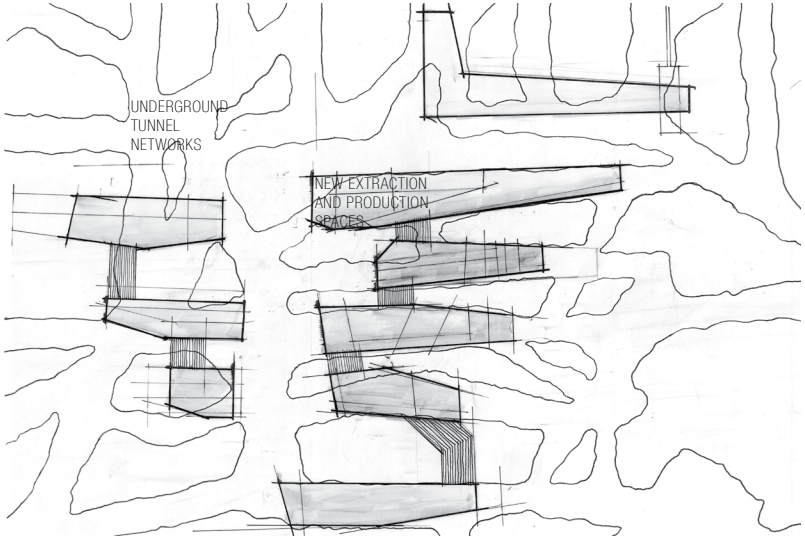
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CONCEPTUAL MODEL 5:

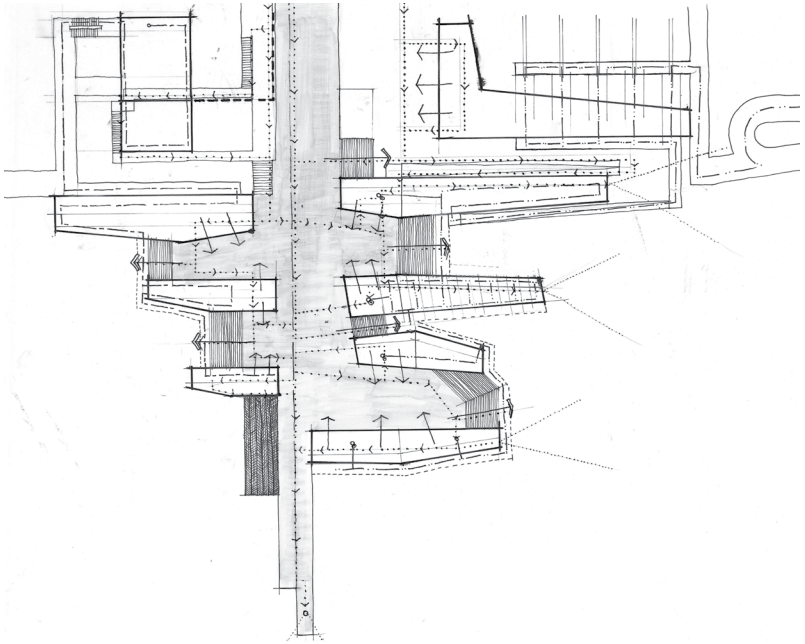


6.41 _ Conceptual model 05 (Author, Mei, 2014).

MODEL 05: This iteration explored how the position of the underground tunnel networks, which where historically associated with extraction and circulation, could be reflected and made visible through the layout and placement of the new extraction and production spaces (see **Figure 6.42**). The experiential promenade and the public spaces between the buildings were further developed to create a variety of contained spaces along the public promenade which the public interface of each production space could spill out onto. The public could then move out into the natural and scarred landscapes from these contained spaces. The relationships between service and public circulation routes was explored in **Figure 6.43.** The essential oil extraction facility was developed as a typology which becomes a continuation of the scarred landscape on various levels.



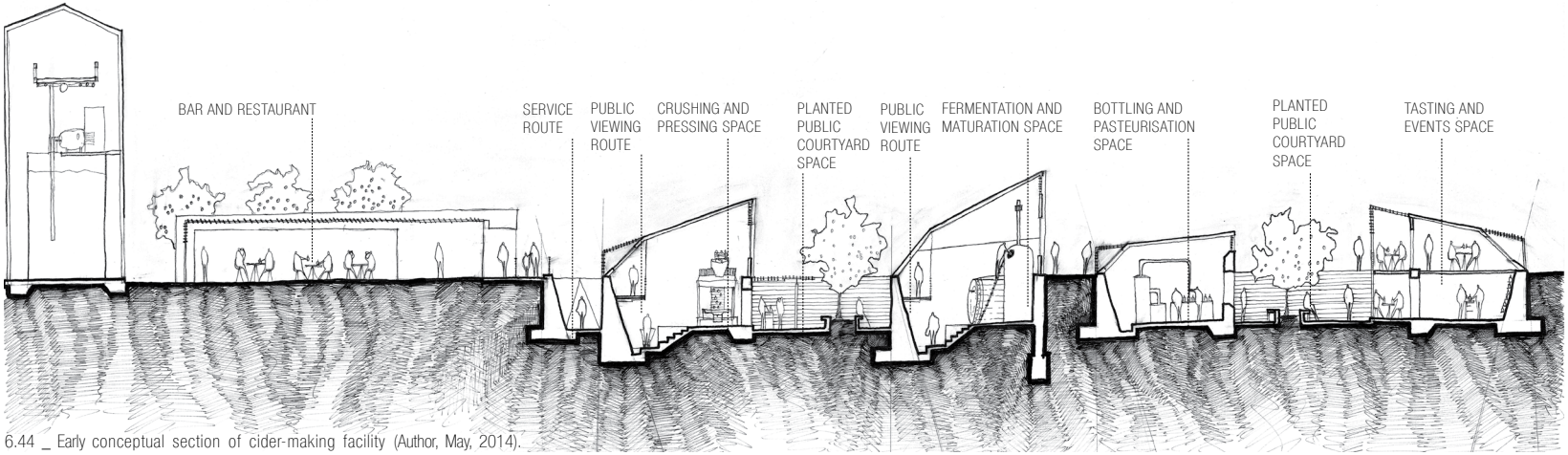
6.42 _ Early conceptual layout of spaces, aligning production and extraction spaces with the position of the underground tunnel networks (Author, Mei, 2014).



6.43 _ Early spatial planning, the production spaces were further developed to define public spaces between the different buildings. The layout of service routes were also explored in relation to public movement(Author, Mei, 2014).

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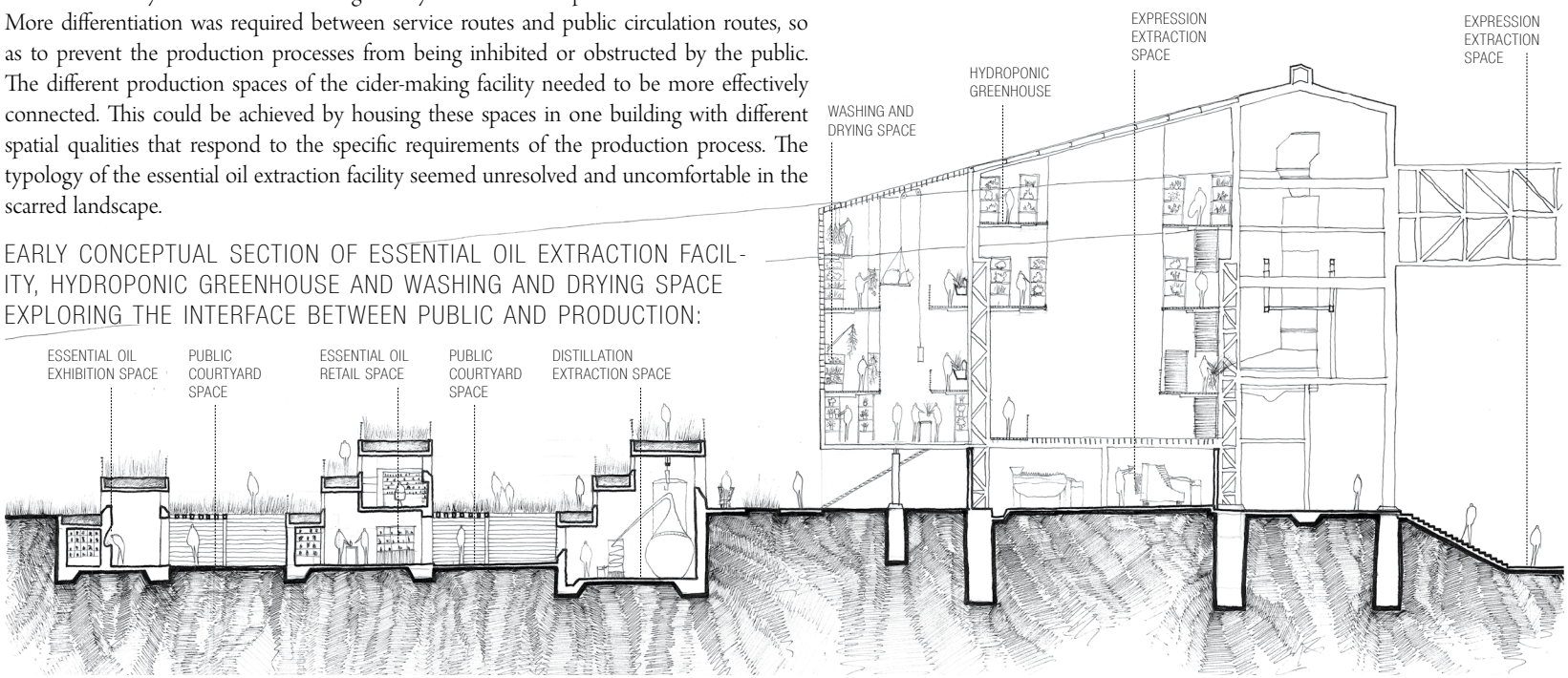
EARLY CONCEPTUAL SECTION OF CIDER-MAKING FACILITY EXPLORING THE INTERFACE BETWEEN PUBLIC AND PRODUCTION:



6.44 _ Early conceptual section of cider-making facility (Author, May, 2014).

REFLECTION: In this design iteration the different production spaces of the essential oil extraction facility and the cider-making facility became too separated and disconnected. More differentiation was required between service routes and public circulation routes, so as to prevent the production processes from being inhibited or obstructed by the public. The different production spaces of the cider-making facility needed to be more effectively connected. This could be achieved by housing these spaces in one building with different spatial qualities that respond to the specific requirements of the production process. The typology of the essential oil extraction facility seemed unresolved and uncomfortable in the scarred landscape.

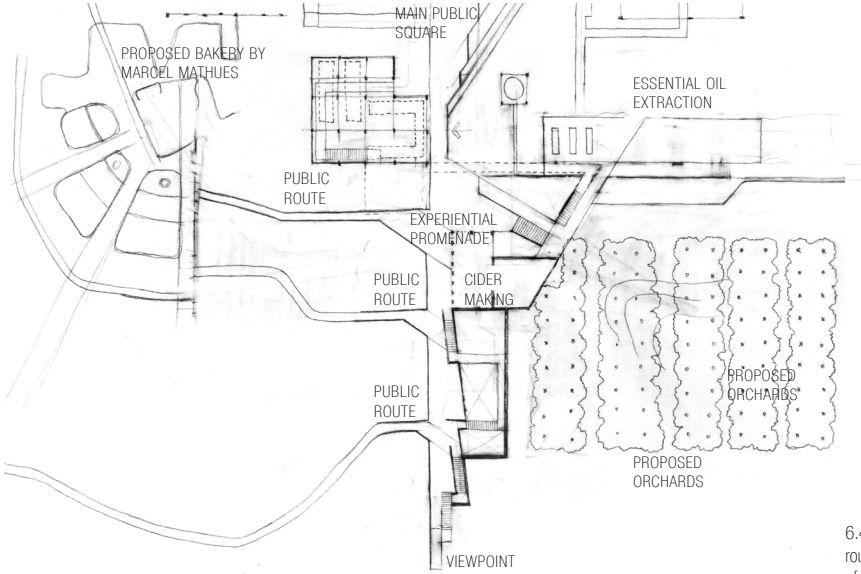
EARLY CONCEPTUAL SECTION OF ESSENTIAL OIL EXTRACTION FACILITY, HYDROPONIC GREENHOUSE AND WASHING AND DRYING SPACE EXPLORING THE INTERFACE BETWEEN PUBLIC AND PRODUCTION:



6.45 _ Early conceptual section of essential oil extraction facility, hydroponic greenhouse and washing and drying space (Author, May, 2014).

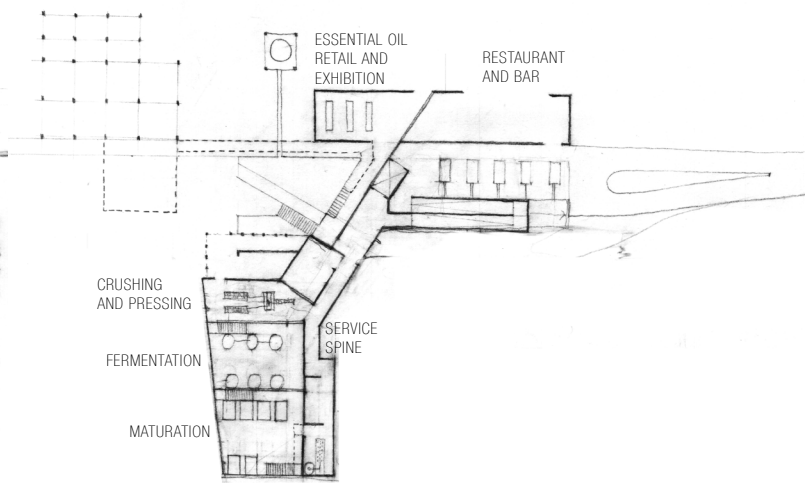
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PLAN LAYOUT DEVELOPMENT 1:



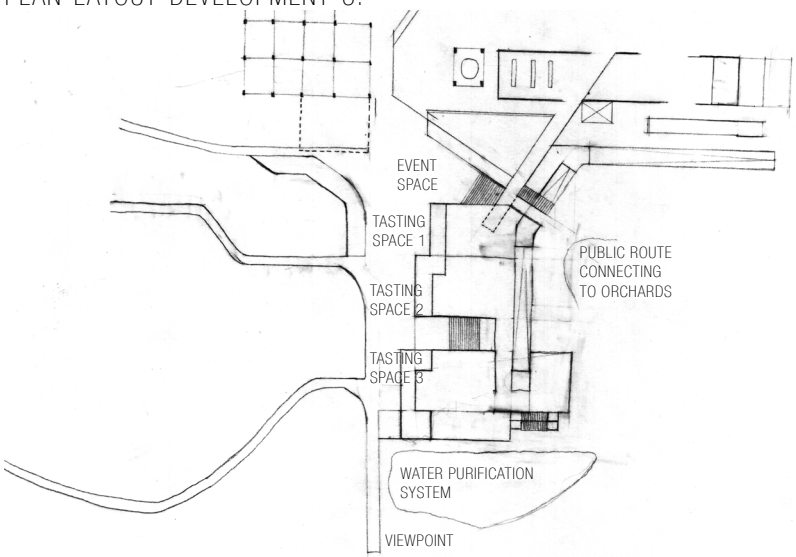
6.46 _ Developing the experiential promenade, public circulation routes are excavated into the scarred landscape reflecting position of underground tunnels and creating connection to the proposed bakery by Marcel Matthues (Author, May, 2014).

PLAN LAYOUT DEVELOPMENT 2:



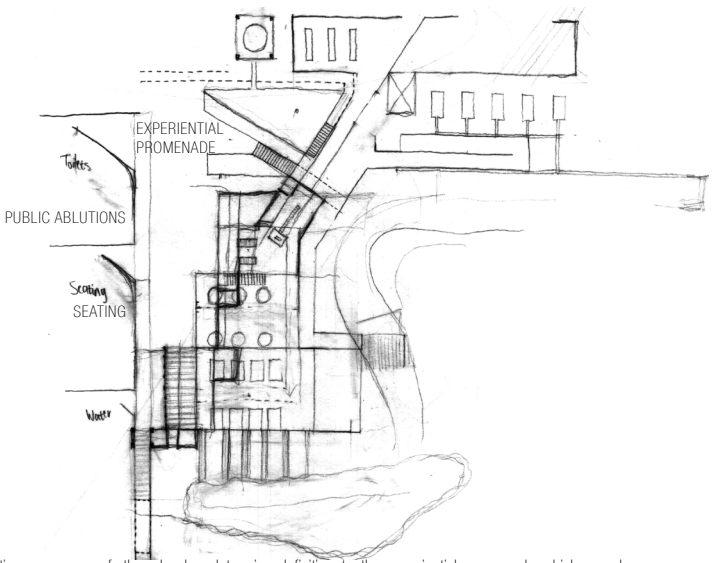
6.48 _ Condensing the various production spaces of the cider-making facility into a single building, developing service routes as a single service spine that is separated from the public realm, leading down to the submerged production spaces. of the cider house. The restaurant and essential oil retail and exhibition space is placed on the ground floor to allow for a direct connection to the main public square (Author, May, 2014).

PLAN LAYOUT DEVELOPMENT 3:



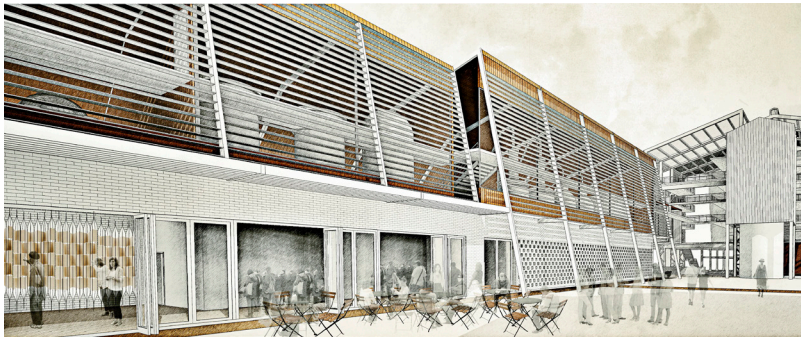
6.47 The various production spaces of the cider-making facility is provided with a public interface in the form of a series of tasting spaces along the experiential promenade to allow for public interaction and experience of production. These spaces project into the promenade and starts to define the public circulation route towards the viewpoint. A diagonal public route connects the event space with the orchards providing public access towards the natural landscape (Author, May, 2014).

PLAN LAYOUT DEVELOPMENT 4:

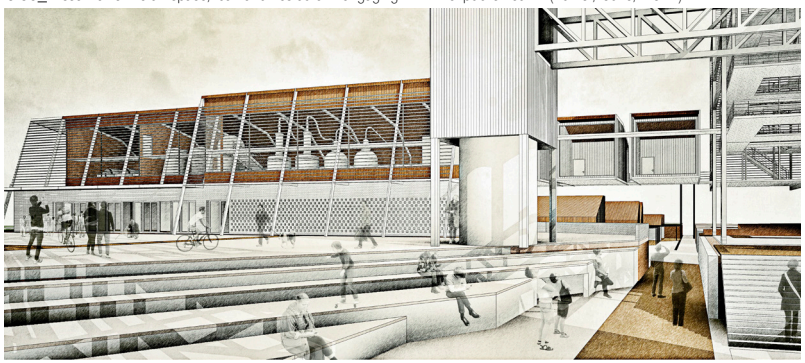


6.49 The tasting spaces are further developed to give definition to the experiential promenade which now becomes narrower towards the viewpoint. This reinforces the concept of moving from a diverse collective experience within the main public square to a focused individual experience at the viewpoint over the open-pit excavation. The thresholds to the public routes within the landscape are given a public function by becoming public ablution and seating. (Author, May, 2014).

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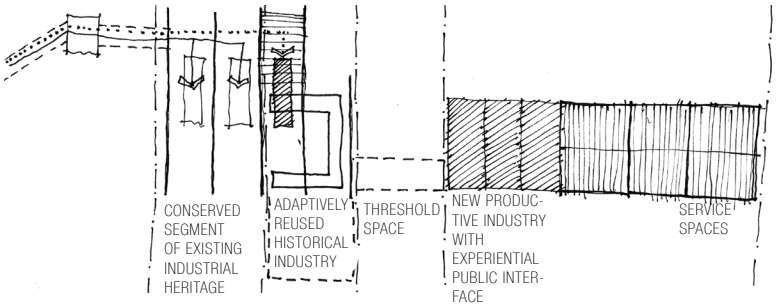
6.50_ Essential oil retail space, bar and restaurant engaging with the public realm (Author, June, 2014).



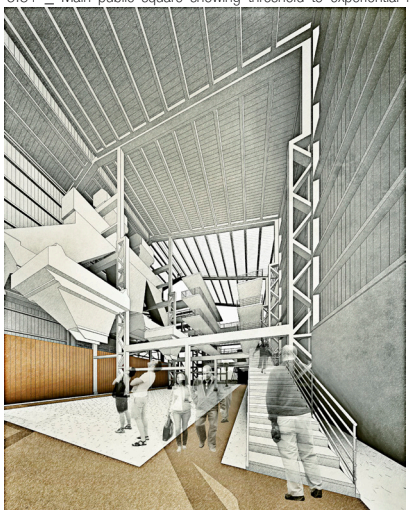
6.51 _ Main public square showing threshold to experiential route (Author, June, 2014).

DESIGN ITERATION 1/ ESSENTIAL OIL EXTRACTION FACILITY

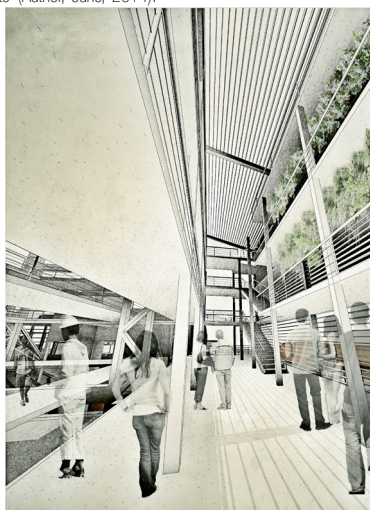
The design of the essential oil extraction facility was informed by the conceptual approach of constructive extraction. By drawing from the principles of the existing industrial heritage buildings and structures, as discussed earlier, a new typology was developed. This typology can therefore be seen as a transformation of the existing industrial typology at the mine. The intention was that the new industry would also read as a physical extraction of the existing crusher building. This would allow the public to gradually move from the conserved section of the crusher building shown in **Figure 6.53**, through the adaptively re-used section functioning as the washing and drying space shown in **Figure 6.54**, and into the new distillation extraction space shown in **Figure 6.55.** From here the public would move out of the building and then descend towards the cider-making facility and tasting and events square shown in **Figure 6.56.**



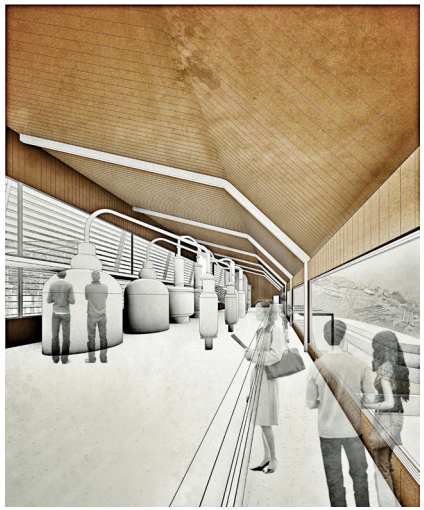
6.52 _ Conceptual diagram showing the gradual progression or movement of the public from the industrial heritage towards the new productive industry (Author, June, 2014).



6.53 _ Conserved section of existing crusher building showing historical machinery (Author, June, 2014).



6.54 _ Washing and drying space as an addition to the existing crusher building (Author, June, 2014).

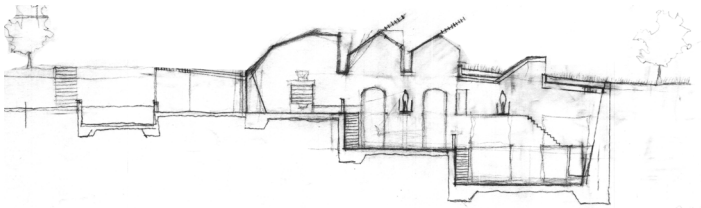


6.55 _ Distillation extraction space showing experiential public route (Author, June, 2014).



6.56 _ Descending towards the tasting and events square (Author, June, 2014).

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6.57 _ Diagram showing how the roof profiles respond to the various lighting and ventilation requirements of the production processes within the cider-making facility (Author, June, 2014).

EXTERIOR VIEWS OF THE CIDER MAKING FACILITY ALONG THE EXPERIENTIAL ROUTE:



6.58 _ Tasting and events square showing the crushing space and the experiential promenade towards the viewpoint (Author, June, 2014).



6.59 _ Shaded public circulation route and fermented cider tasting space (Author, June, 2014).



6.60 _ Public edge of cider-making facility (Author, June, 2014).

DESIGN ITERATION 1/ CIDER MAKING FACILITY

The roof profiles of the various production spaces within the cider-making facility were primarily informed by the ventilation and lighting requirements of each production process (see **Figure 6.57**). The intention was that these roof profiles slope up on the southern side in order to bring in as much indirect, soft natural light as possible. This would prevent the possible overheating of the interior spaces due to direct northern light. The facades opening up to the public edge were facing west and were therefore provided with vertical louvers to prevent overheating during the late afternoon.

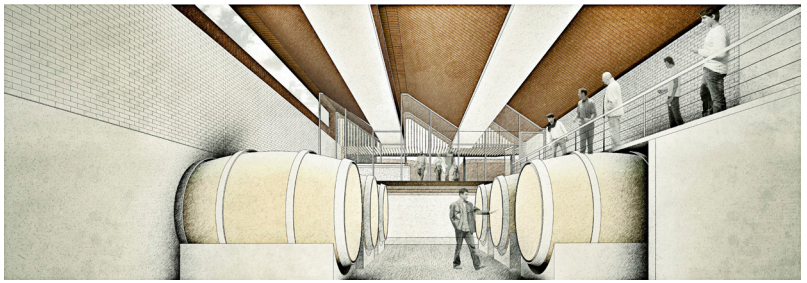
INTERIOR VIEWS OF THE CIDER MAKING FACILITY SHOWING THE EXPERIENTIAL INTERFACE BETWEEN THE PUBLIC AND PRODUCTION:



6.61 _ Crushing, pressing and unfermented juice tasting space (Author, June, 2014).



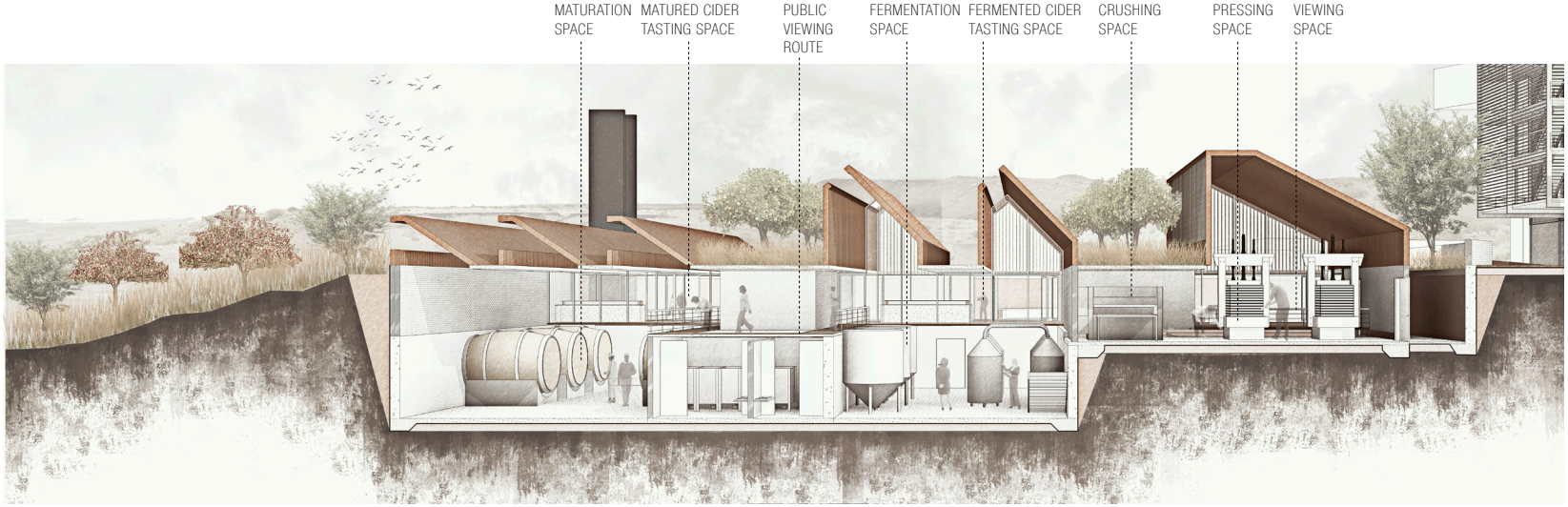
6.62 _ Fermentation space showing elevated public viewing route with production below (Author, June, 2014).



6.63 _ Maturation space showing elevated public viewing route with production below (Author, June, 2014).

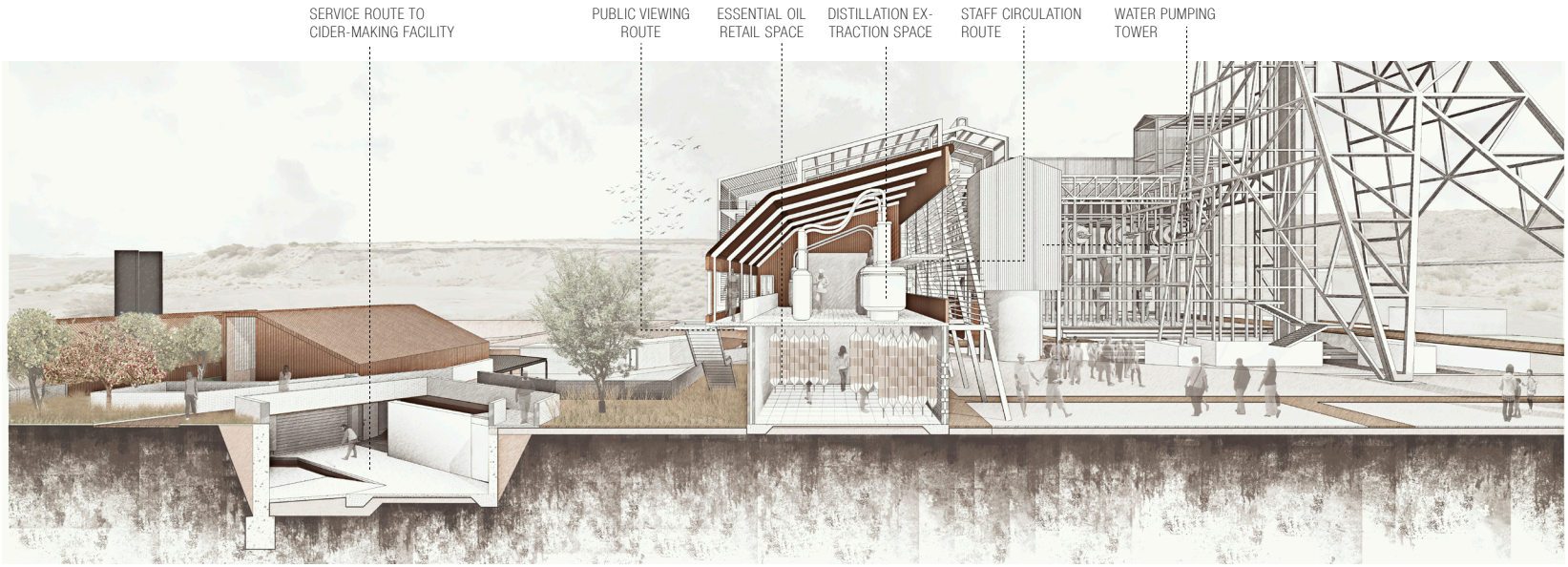
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DESIGN ITERATION 1/ EARLY SPATIAL SECTION OF CIDER-MAKING FACILITY



6.64 _ Early section of Cider-making facility showing the various production spaces. The different roof profiles bring in soft indirect southern light and also allow for the natural ventilation of carbon-dioxide which builds up during in the fermentation space. (Author, June, 2014).

DESIGN ITERATION 1/ EARLY SPATIAL SECTION OF ESSENTIAL OIL EXTRACTION FACILITY

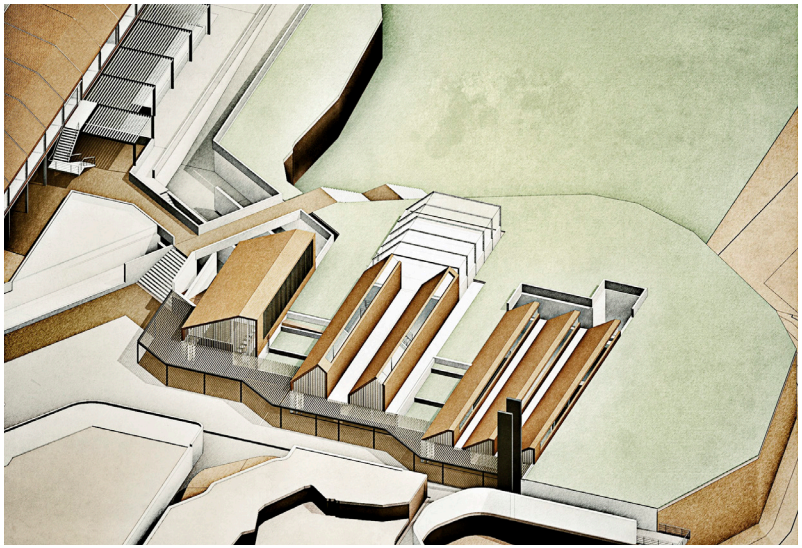


6.65 _ Early section of the Essential oil extraction facility showing the distillation extraction space on 1st floor with the essential oil retail space on ground floor. A double envelope system consisting of a louvered environmental skin allows the distillation extraction space to completely open up for natural ventilation during distillation while still preventing overheating due to direct northern light. (Author, June, 2014).

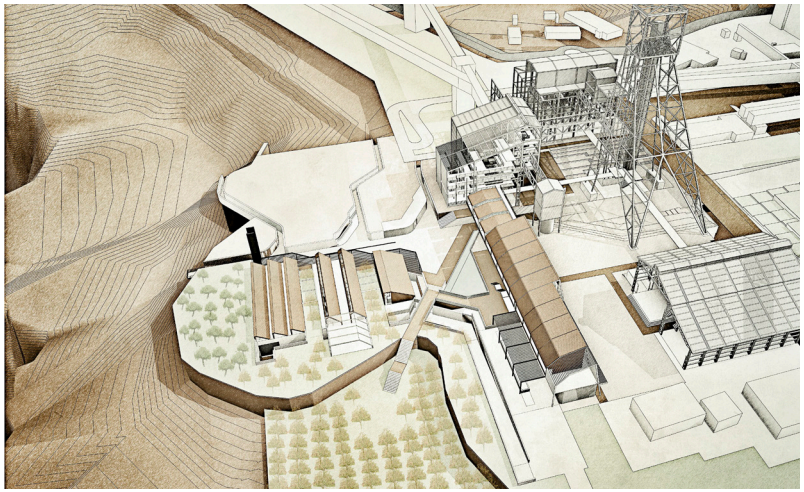
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DESIGN ITERATION 1/ BIRDS-EYE VIEW

From this view it becomes apparent that the roof profiles of the cider-making facility sit uncomfortably in the natural landscape, even though they are informed by the internal productive processes.



6.66 _ Western birds-eye view of 1st design iteration. (Author, June, 2014).



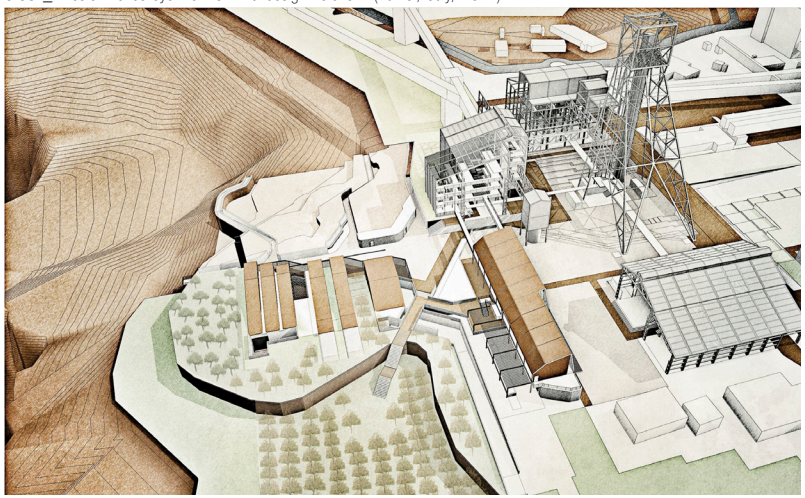
6.67 _ Eastern birds-eye view of 1st design iteration. (Author, June, 2014).

DESIGN ITERATION 2/ BIRDS-EYE VIEW

The following design iteration explored an alternative typology for the roofs of the cider-making facility. These gradually sloped out of the natural landscape to establish a clearly defined public edge along the experiential promenade. This typology was more effective in defining and distinguishing the production spaces contained within submerged underground spaces from public tasting and event spaces along the public promenade.



6.68 _ Western birds-eye view of 2nd design iteration. (Author, July, 2014).



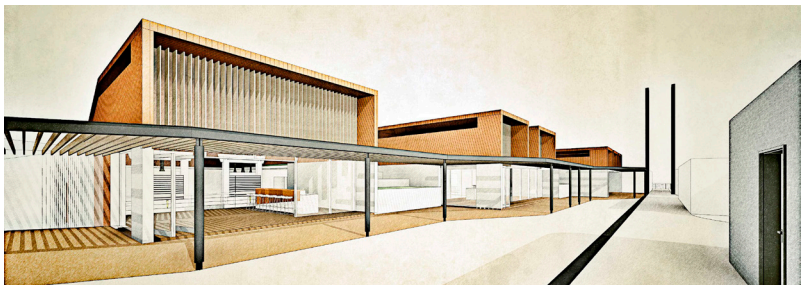
6.69 _ Eastern birds-eye view of 2nd design iteration. (Author, July, 2014).

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DESIGN ITERATION 2/ CIDER MAKING FACILITY

This iteration was found to establish a more appropriate relationship with the productive natural landscape and was more effective in distinguishing public and production spaces. More appropriate interior spaces were also created while still responding to the functional and spatial requirements of the production processes. The edge that was created towards the public promenade (see **Figures 6.70 - 6.72**) became monotonous and needed more definition and differentiation. The pergola structure that defined public circulation also became too rigid and obtrusive.

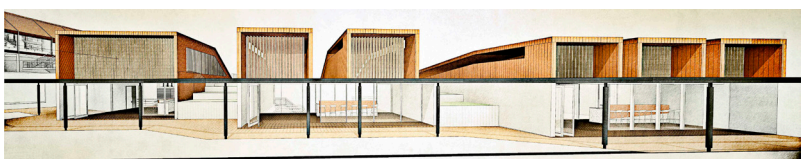
EXTERIOR VIEWS OF THE CIDER MAKING FACILITY ALONG THE EXPERIENTIAL ROUTE:



6.70 _ Tasting and events square showing the crushing space and the experiential promenade towards the viewpoint (Author, July, 2014).

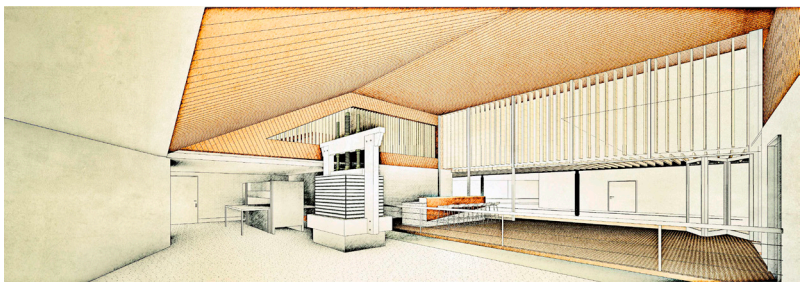


6.71 _ Shaded public circulation route and fermented cider tasting space (Author, July, 2014).

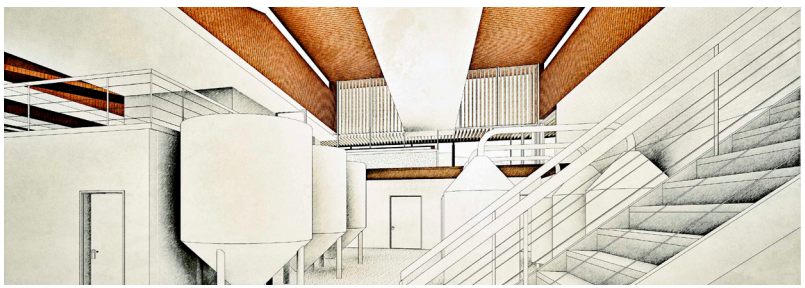


6.72 _ Public edge of cider-making facility (Author, July, 2014).

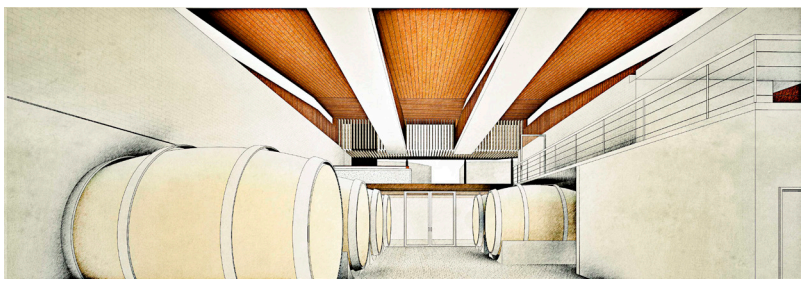
INTERIOR VIEWS OF THE CIDER MAKING FACILITY SHOWING THE EXPERIENTIAL INTERFACE BETWEEN THE PUBLIC AND PRODUCTION:



6.73 _ Crushing, pressing and unfermented juice tasting space (Author, July, 2014).



6.74 _ Fermentation space showing elevated public viewing route with production below (Author, July, 2014).



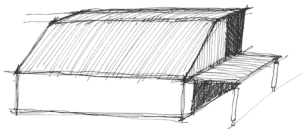
6.75 _ Maturation space showing elevated public viewing route with production below (Author, July, 2014).

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DESIGN DEVELOPMENT/ BUILDING ENVELOPE

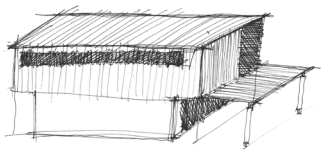
The following section contains a series of drawings that illustrate the gradual development of the envelopes of both the cider-making facility and the essential oil extraction facility, in response to the architectural intentions and the conceptual approach described earlier in this chapter.

ITERATION 1/ APRIL



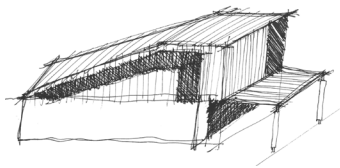
6.76 _ (Author, 2014).

ITERATION 2/ APRIL



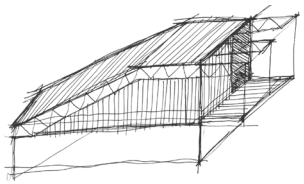
6.77 _ (Author, 2014).

ITERATION 3/ MAY



6.78 _ (Author, 2014).

ITERATION 4/ MAY



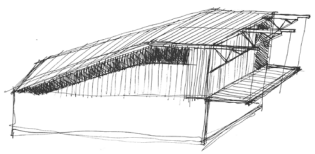
6.79 _ (Author, 2014).

ITERATION 5/ MAY



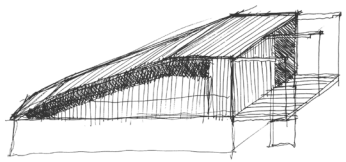
6.80 _ (Author, 2014).

ITERATION 6/ JUNE



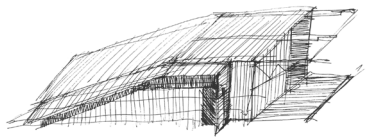
6.81 _ (Author, 2014).

ITERATION 7/ JUNE



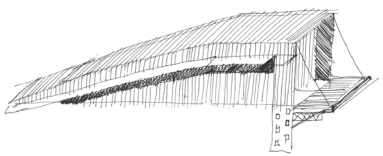
6.82 _ (Author, 2014).

ITERATION 8/ JUNE



6.83 _ (Author, 2014).

ITERATION 9/ JULY



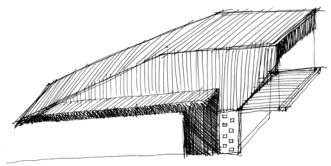
6.84 _ (Author, 2014).

ITERATION 10/ AUGUST



6.85 _ (Author, 2014).

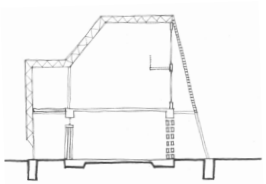
ITERATION 11/ SEPTEMBER



6.86 _ (Author, 2014).

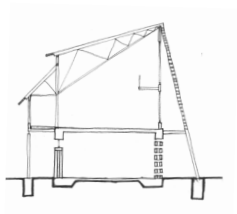
DESIGN DEVELOPMENT _ ESSENTIAL OIL EXTRACTION FACILITY ENVELOPE:

ITERATION 1/ APRIL



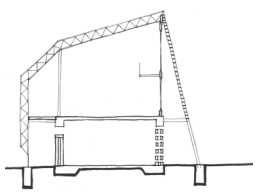
6.87 _ (Author, 2014).

ITERATION 1/ MAY



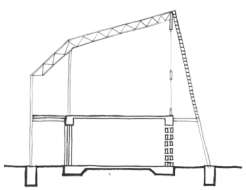
6.88 _ (Author, 2014).

ITERATION 1/ JUN



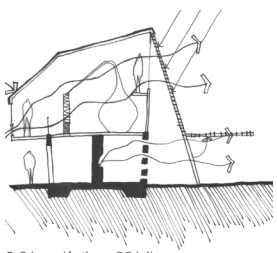
6.89 _ (Author, 2014).

ITERATION 1/ JULY



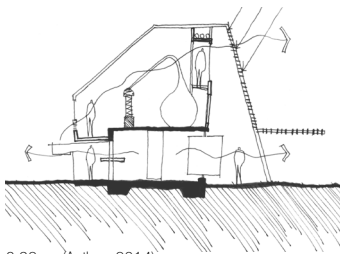
6.90 _ (Author, 2014).

ITERATION 1/ AUGUST



6.91 _ (Author, 2014).

ITERATION 1/ SEPTEMBER



6.92 _ (Author, 2014).

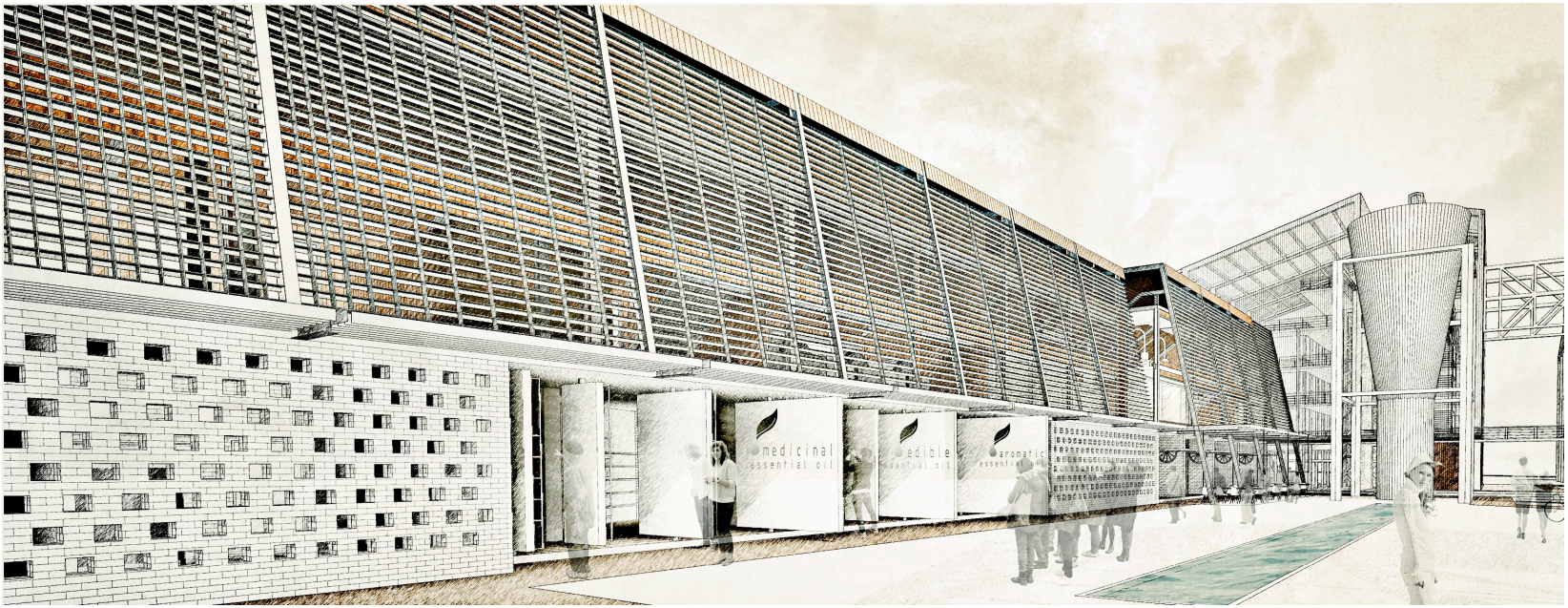
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DESIGN ITERATION 3/ ESSENTIAL OIL EXTRACTION FACILITY:

In this iteration the envelope and internal layout of the essential oil retail space, the restaurant and the bar were further developed. The intention of the porous envelope, as shown in Figure 6.84, was not only to act as an environmental control device but to also selectively reveal and exhibit the various extraction processes to the public realm. This would contribute to increasing the expectation and intrigue of visitors concerning the extraction processes, and encourage the public to embark on an experiential journey through the new productive industry. Through this experiential journey a deeper understanding and appreciation of the existing industrial heritage and the new productive industry can be gained. This new approach to the envelope of an industrial typology, being more porous and revealing, exposes its content and functions to the external environment. It therefore contrasts with the existing industrial typology at the mine, which is introverted and reclusive (see **Figure 6.93**). This envelope becomes denser towards the service spaces within the essential oil extraction facility to provide a degree of privacy to the staff, as shown in the left corner of **Figure 6.94.** The service spaces like the staff restrooms and restaurant ablution areas are provided with woven masonry walls to allow for effective ventilation.



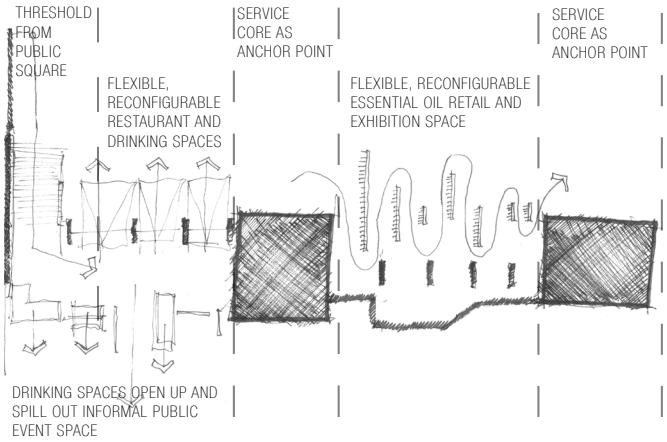
6.93 _ The existing typology of the crusher house at the mine is introverted and reclusive, not giving any indication of its function or contents to the exterior environment (Author, 2014).



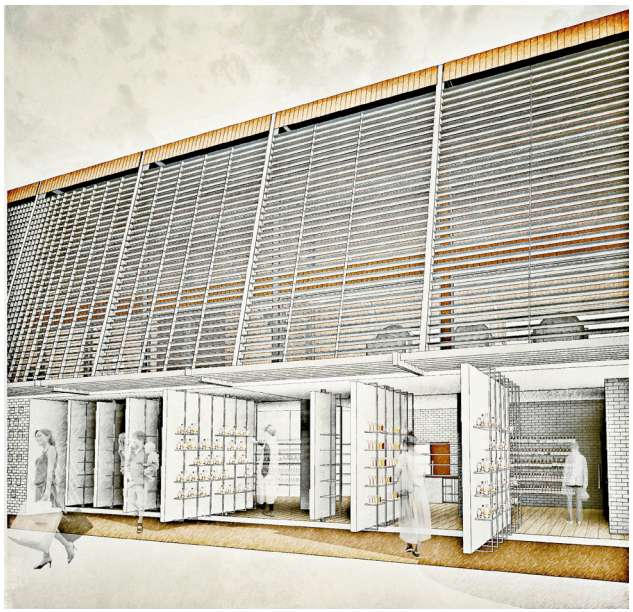
6.94 _ Essential oil extraction facility with the essential oil retail space on ground level and the various extraction spaces above. (Author, 2014).

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6.95 _ Conceptual diagram showing the two service cores as the heavy anchors of the building while the essential oil retail and the restaurant and bar become flexible spaces able to adapt and reconfigure (Author, 2014).



6.96 _ Essential oil retail space with display panels that open up to collapse the threshold between public circulation and retail (Author, 2014).

DESIGN ITERATION 3/PUBLIC SPACES

The essential oil retail and exhibition space, and the bar and restaurant which are the most public in nature, are contained between two service cores that function as the anchors of the building (see **Figure 6.95**). These spaces can now freely open up towards the public realm, as they are able to be adapted and reconfigured, while collapsing the boundaries between public circulation and retail (see **Figure 6.96**). In the essential oil retail and exhibition space this is achieved with swiveling display panels which can be reconfigured to allow for various patterns of circulation through the space, as shown in **Figure 6.97.** At the bar and tasting spaces the wall panels pivot and open up to become seating and serving spaces (see **Figure 6.98**).



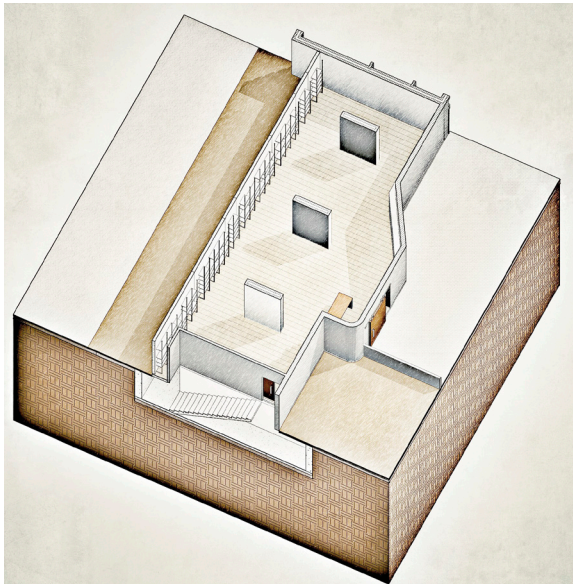
6.97 _ Informal drinking spaces and bar opening up towards the public square. Glass pivot doors allow for a spatial continuity between inside and outside. (Author, 2014).



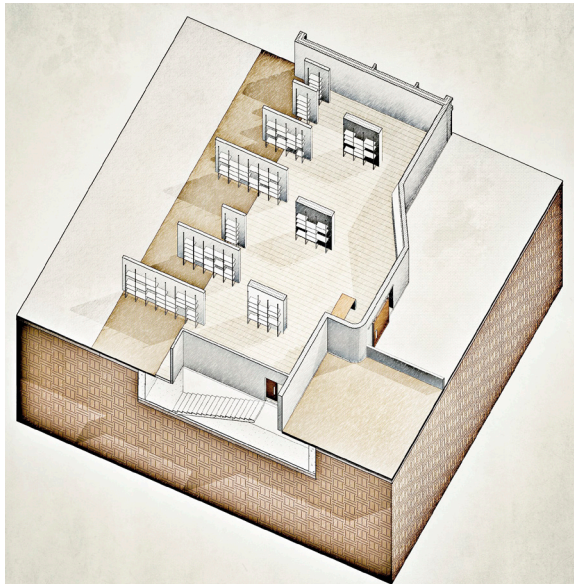
6.98 _ Informal drinking spaces and bar opening up towards the public square. Glass pivot doors allow for a spatial continuity between inside and outside. (Author, 2014).

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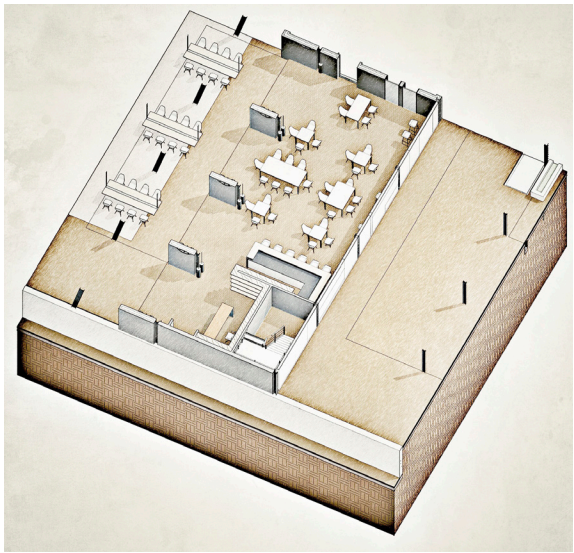
PUBLIC SPACES/ OPENING UP TO RECONFIGURE AND ADAPT



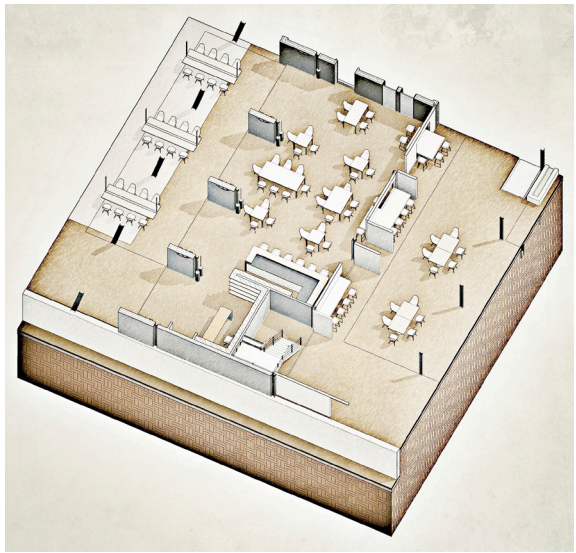
6.99 _ Essential oil retail space closed (Author, 2014).



6.101 _ Essential oil retail space opened up (Author, 2014).

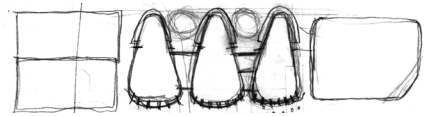


6.100 _ Bar and restaurant space closed (Author, 2014).

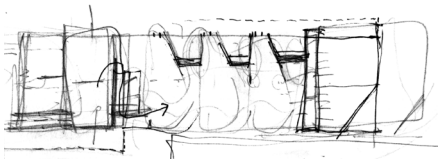


6.102 _ Bar and restaurant space opened up (Author, 2014).

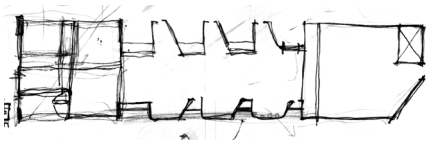
CONCEPTUAL DEVELOPMENT OF ESSENTIAL OIL RETAIL SPACE:



6.103 _ Essential oil retail space first iteration (Author, 2014).



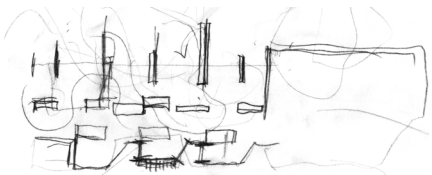
6.104 _ Essential oil retail space second iteration (Author, 2014).



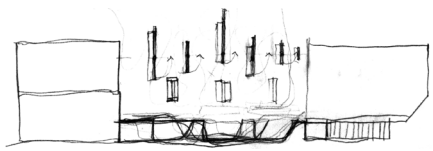
6.105 _ Essential oil retail space third iteration (Author, 2014).



6.106 _ Essential oil retail space fourth iteration (Author, 2014).



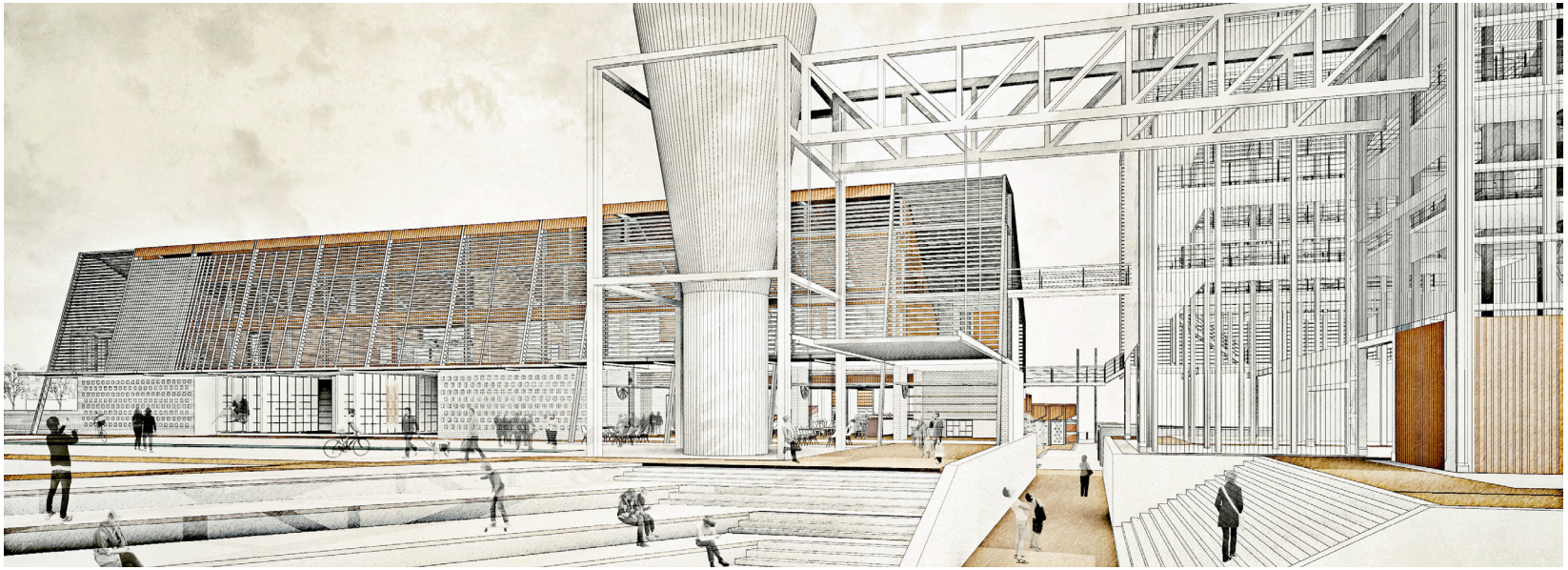
6.107 _ Essential oil retail space fourth iteration (Author, 2014).



6.108 _ Essential oil retail space final iteration (Author, 2014).

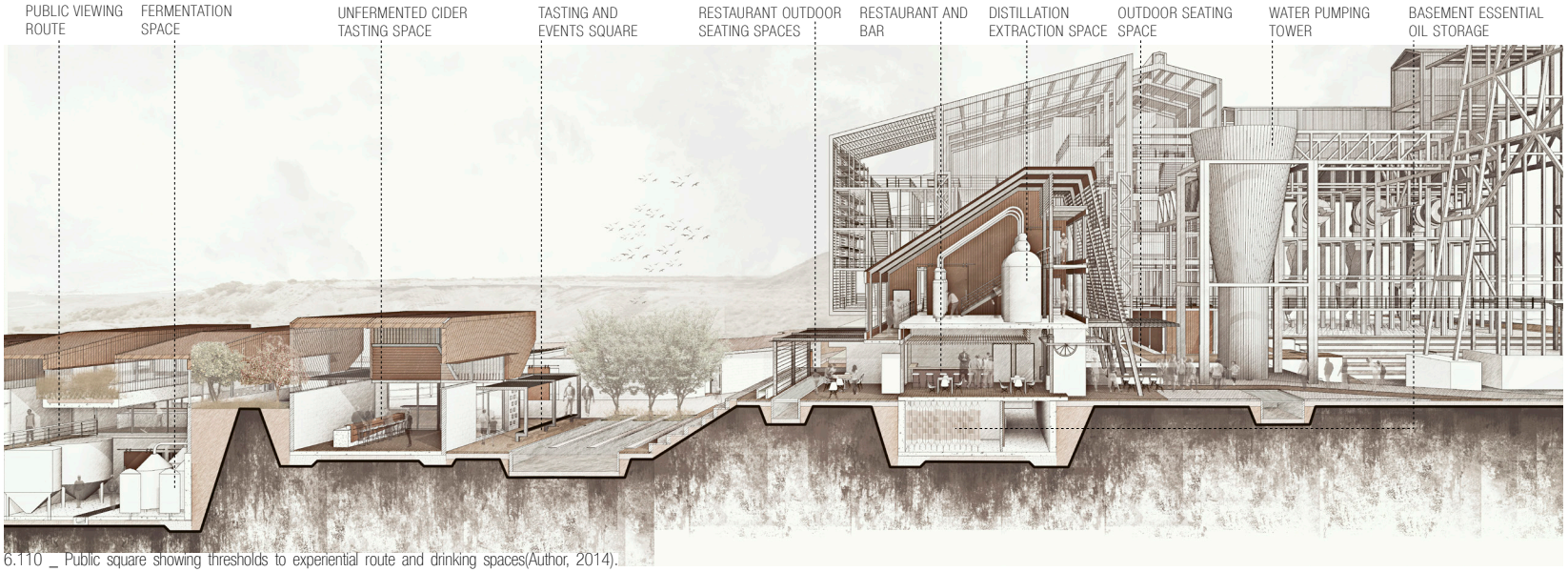
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DESIGN ITERATION 3/ THRESHOLD TO EXPERIENTIAL ROUTE



6.109 _ Public square showing thresholds to experiential route and drinking spaces(Author, 2014).

SPATIAL CROSS SECTION/ CIDER MAKING FACILITY SHOWING VARIOUS PRODUCTION SPACES



6.110 _ Public square showing thresholds to experiential route and drinking spaces(Author, 2014).

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DESIGN ITERATION 3/EXPERIENTIAL ROUTE:



6.111 _ Conserved section of existing crusher building showing historical machinery (Author, 2014).



6.113 _ Washing and drying space as an addition to the existing crusher building (Author, 2014).



6.112 _ Distillation extraction space showing the experiential public route at a lower level. (Author, 2014).

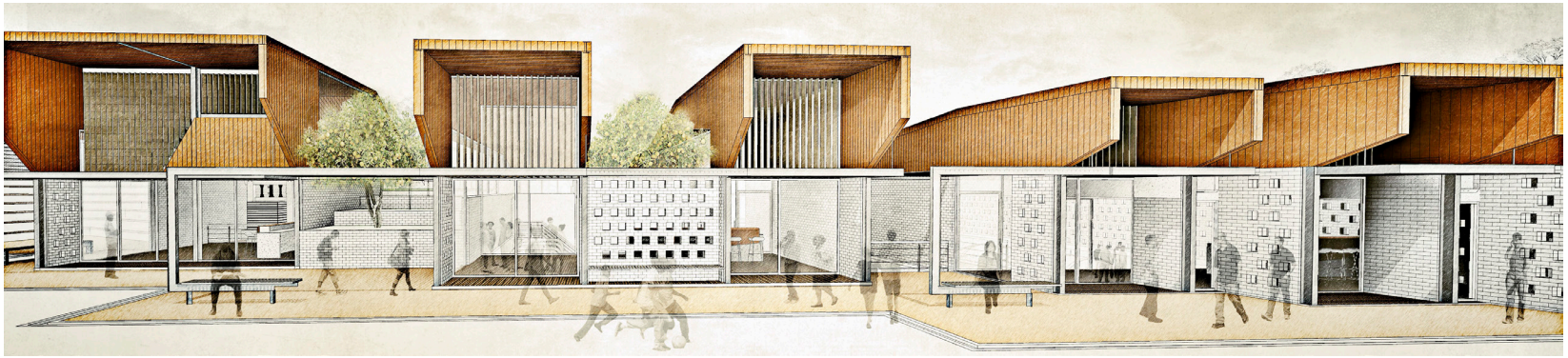


6.114 _ Descending towards the event and tasting square (Author, 2014).

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DESIGN ITERATION 3/ CIDER MAKING FACILITY

A prominent public edge is established by the cider-making facility along the experiential route through the scarred landscape. This is achieved by means of the roof structure which gradually slopes out of the landscape to contain the edge, while the scale is brought down with a suspended pergola structure that creates a covered public circulation route without obstructing the flow of people (see **Figure 6.115**). This structure is manipulated at certain points to become public seating, as shown in **Figure 6.116.**



6.115 _ public circulation along the edge of the cider-making facility (Author, 2014).

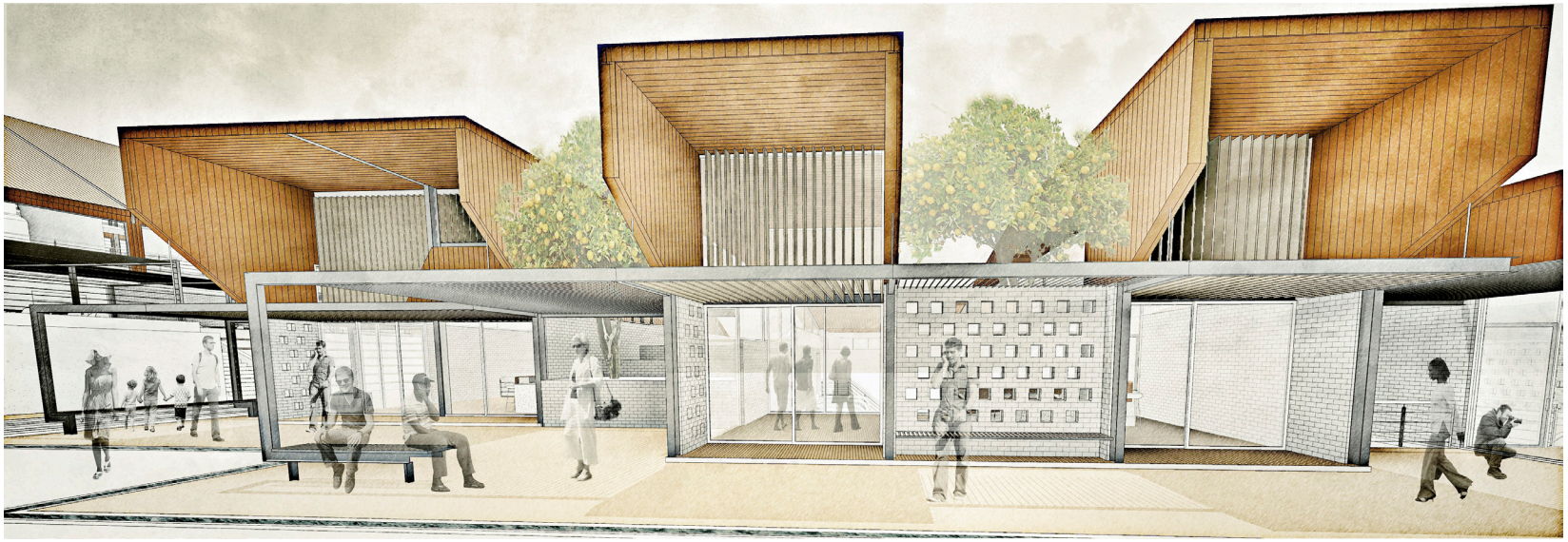


6.116 _ The public edge established by the cider-making facility becomes an experiential route towards the viewpoint (Author, 2014).

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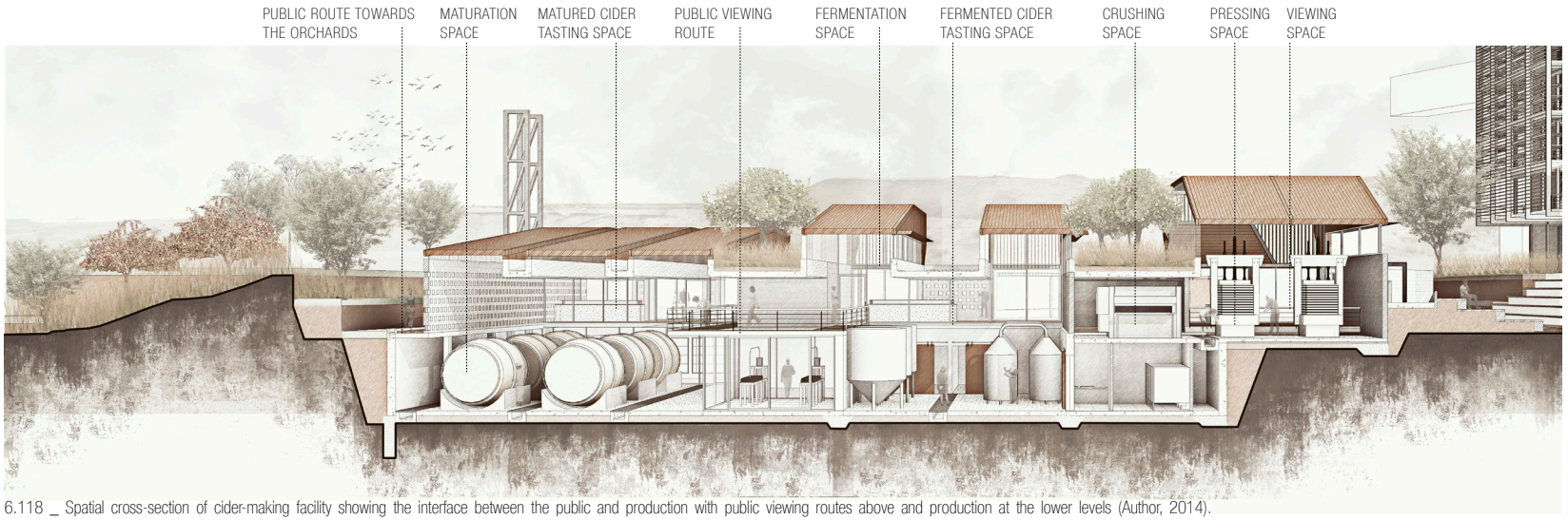
DESIGN ITERATION 3/ TASTING SPACES

An interface between public experience and industrial production is established where the experiential promenade intersects the proposed industry in the form of various tasting spaces and a public viewing route.



6.117 _ Public seating and thresholds leading towards the various tasting spaces (Author, 2014).

SPATIAL CROSS SECTION/ OF CIDER MAKING FACILITY SHOWING VARIOUS PRODUCTION SPACES

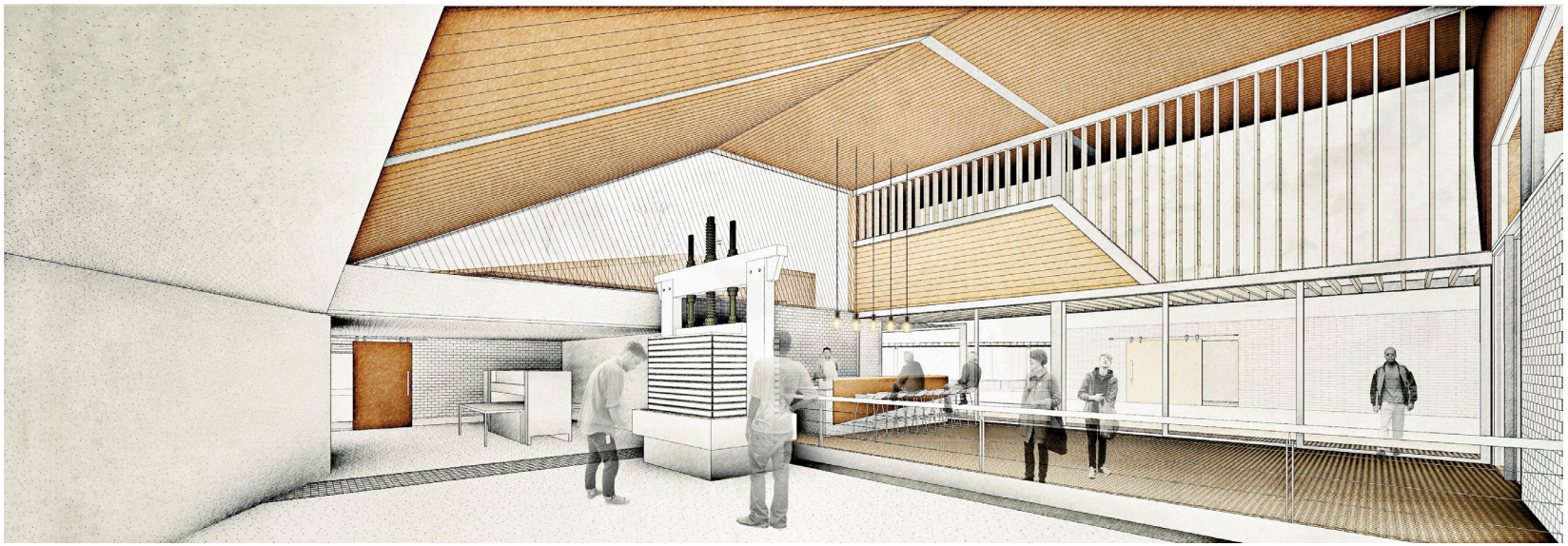


6.118 _ Spatial cross-section of cider-making facility showing the interface between the public and production with public viewing routes above and production at the lower levels (Author, 2014).

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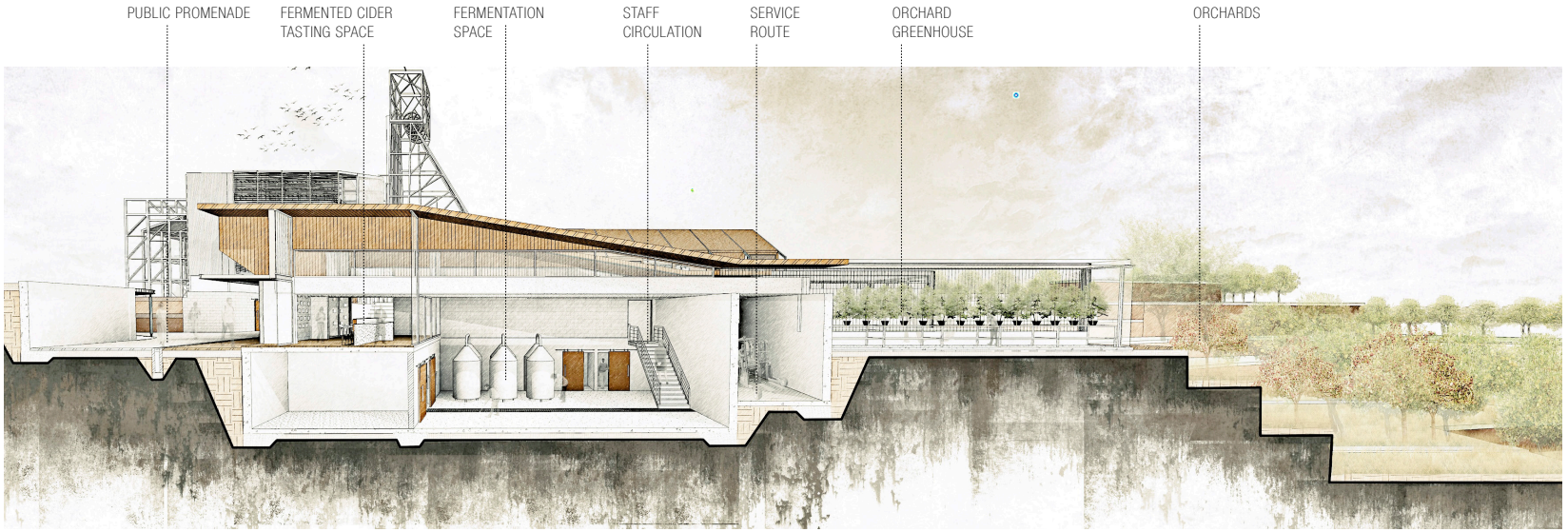
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DESIGN ITERATION 3/ EXPERIENTIAL INTERFACE BETWEEN THE PUBLIC AND PRODUCTION



6.119 _ Crushing, pressing and unfermented juice tasting space, showing how the public is able to view and experience the first part of the production process while tasting the freshly pressed juice. (Author, 2014).

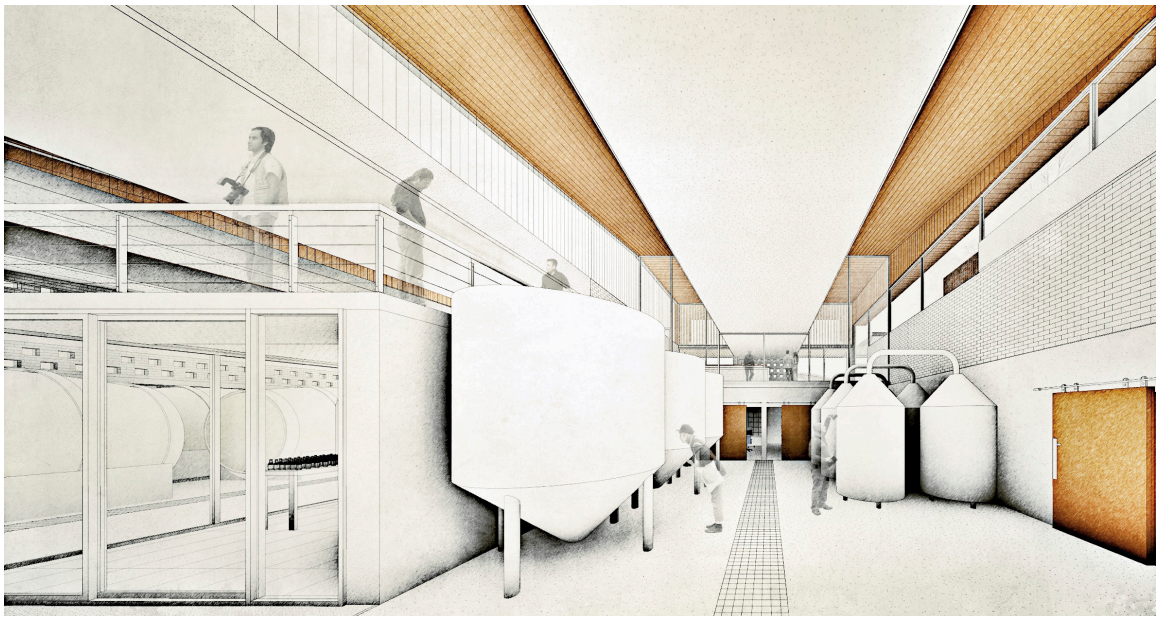
LONGITUDINAL-SECTION/ FERMENTATION SPACE AND ORCHARD GREENHOUSE



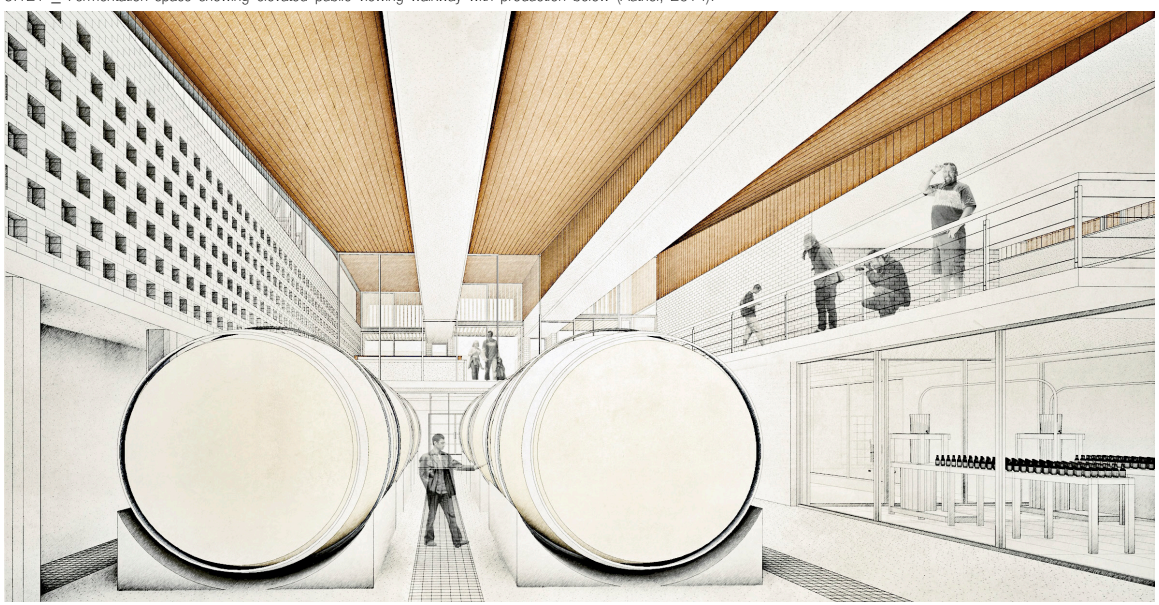
6.120 _ Longitudinal section through the fermentation space and orchard greenhouse showing how the new roof typology gradually slopes out of the landscape to establish an edge along the public promenade (Author, 2014).

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DESIGN ITERATION 3/EXPERIENTIAL INTERFACE BETWEEN THE PUBLIC AND PRODUCTION/



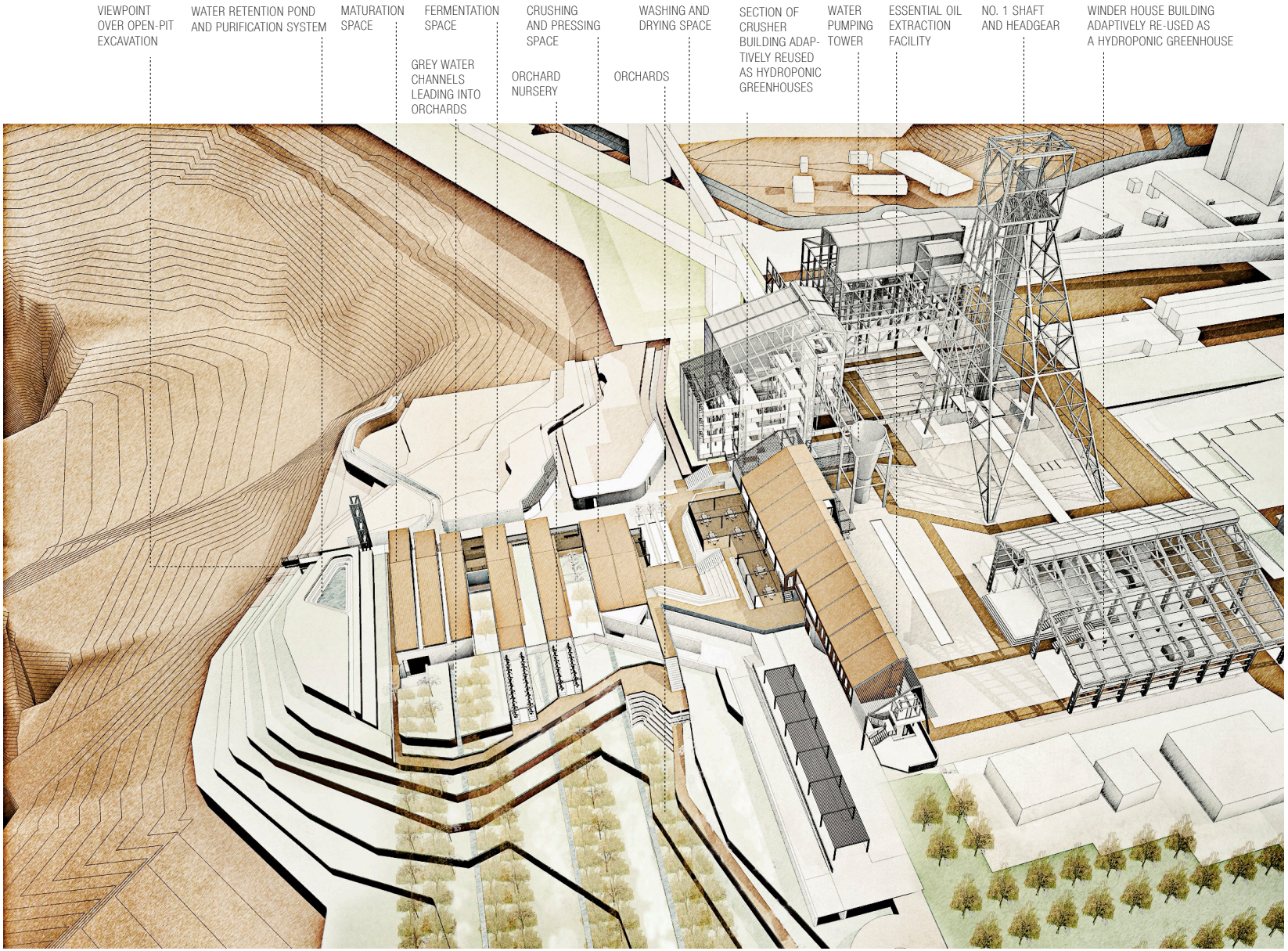
6.121 _ Fermentation space showing elevated public viewing walkway with production below (Author, 2014).



6.122 _ Maturation space showing elevated public viewing walkway with production below (Author, 2014).

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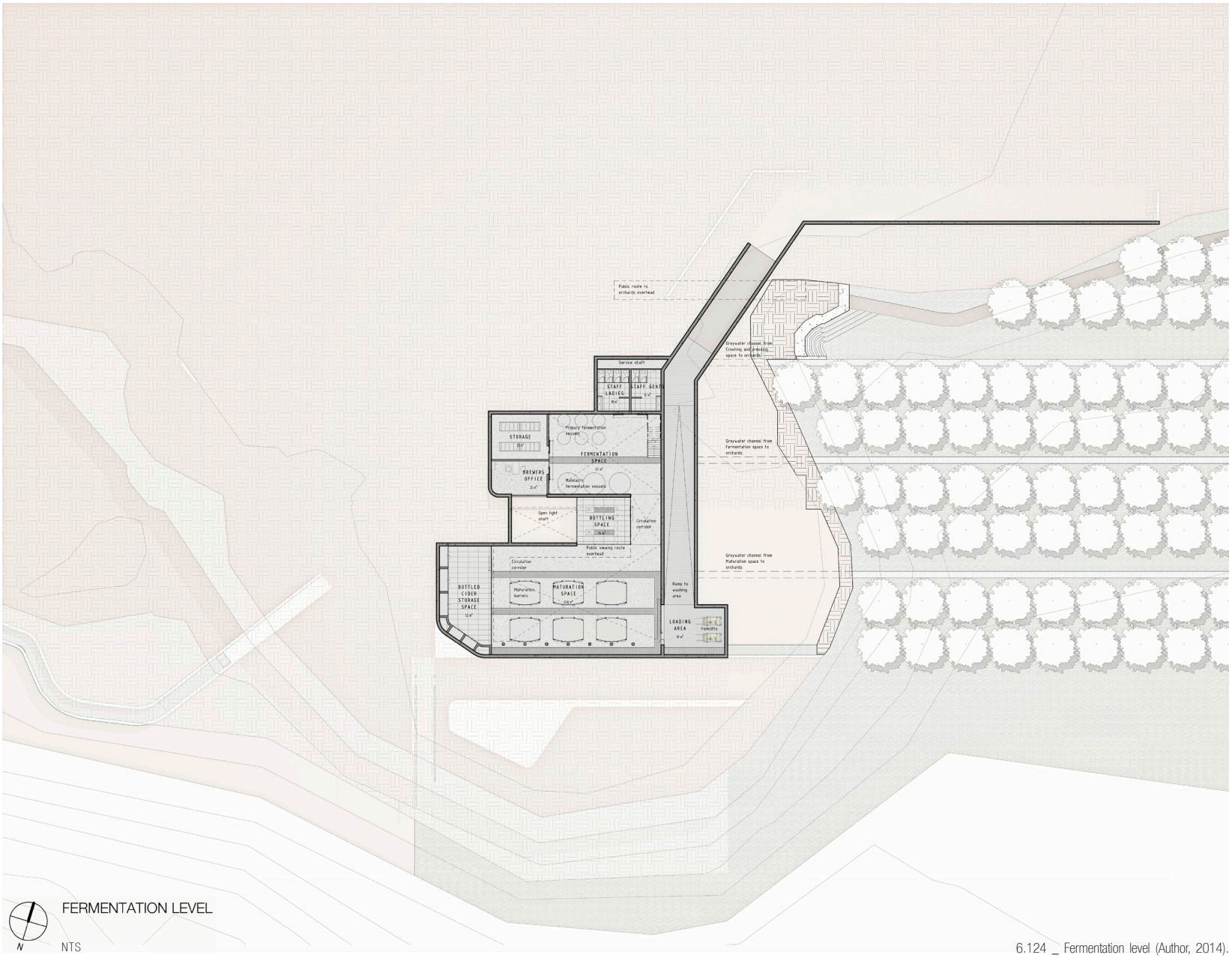
DESIGN ITERATION 3/ SOUTHWESTERN BIRDS EYE VIEW



6.123 _ South-eastern birds-eye view showing the new relationship that is established with the existing industrial heritage, the natural landscape and the scarred landscape (Author, 2014).

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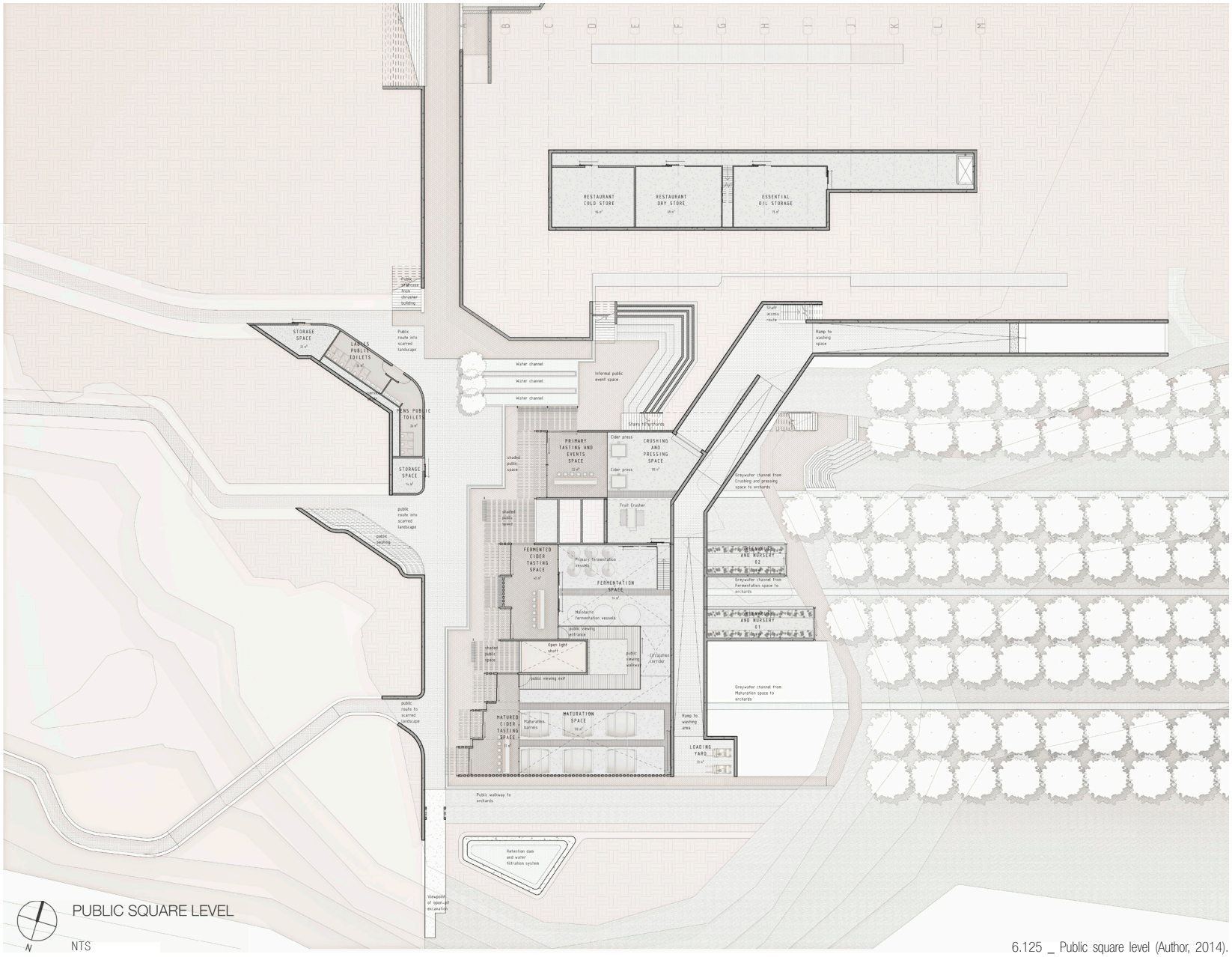
DESIGN ITERATION 3/ FERMENTATION LEVEL PLAN:



6.124 _ Fermentation level (Author, 2014).

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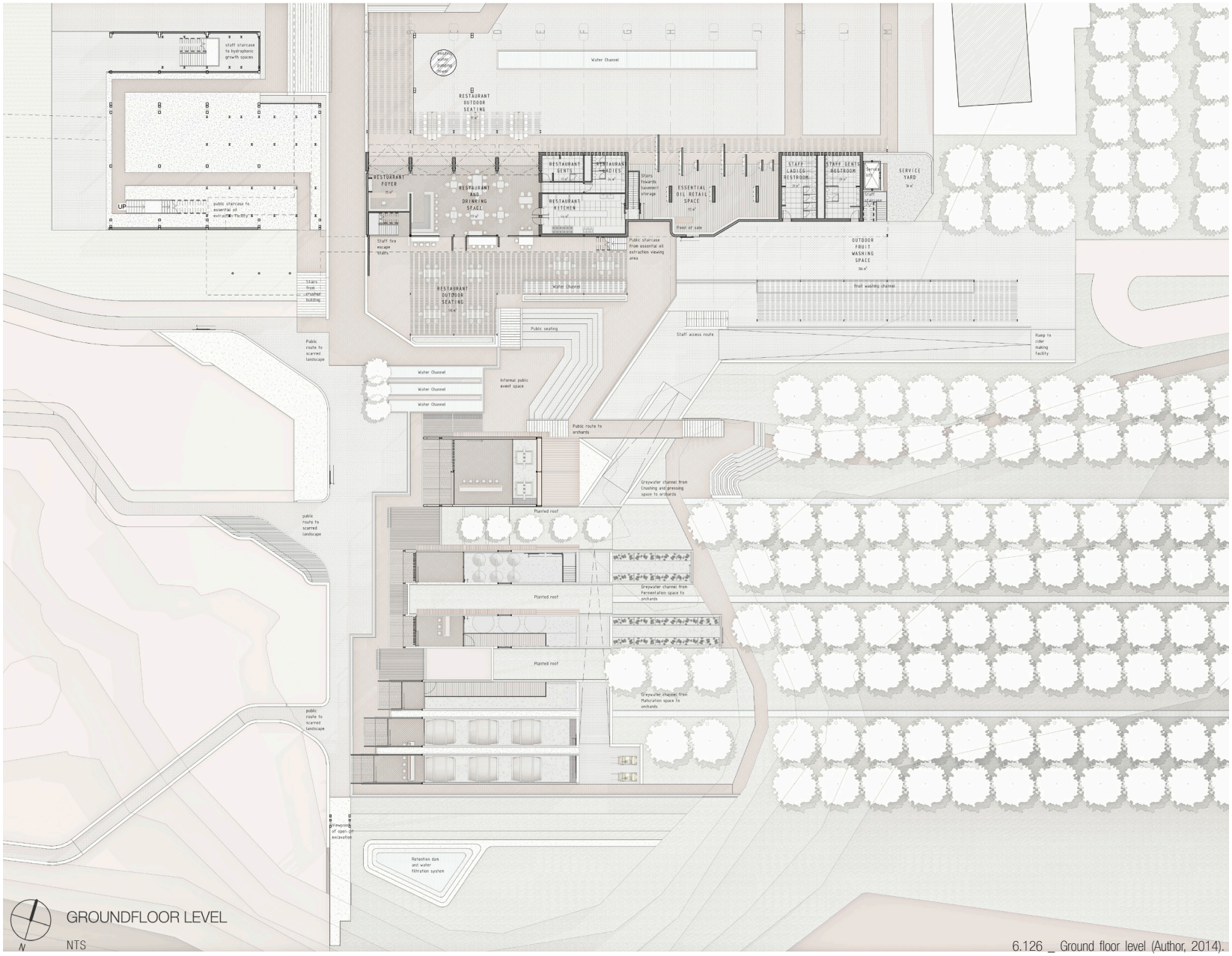
DESIGN ITERATION 3/ PUBLIC SQUARE LEVEL PLAN:



6.125 _ Public square level (Author, 2014).

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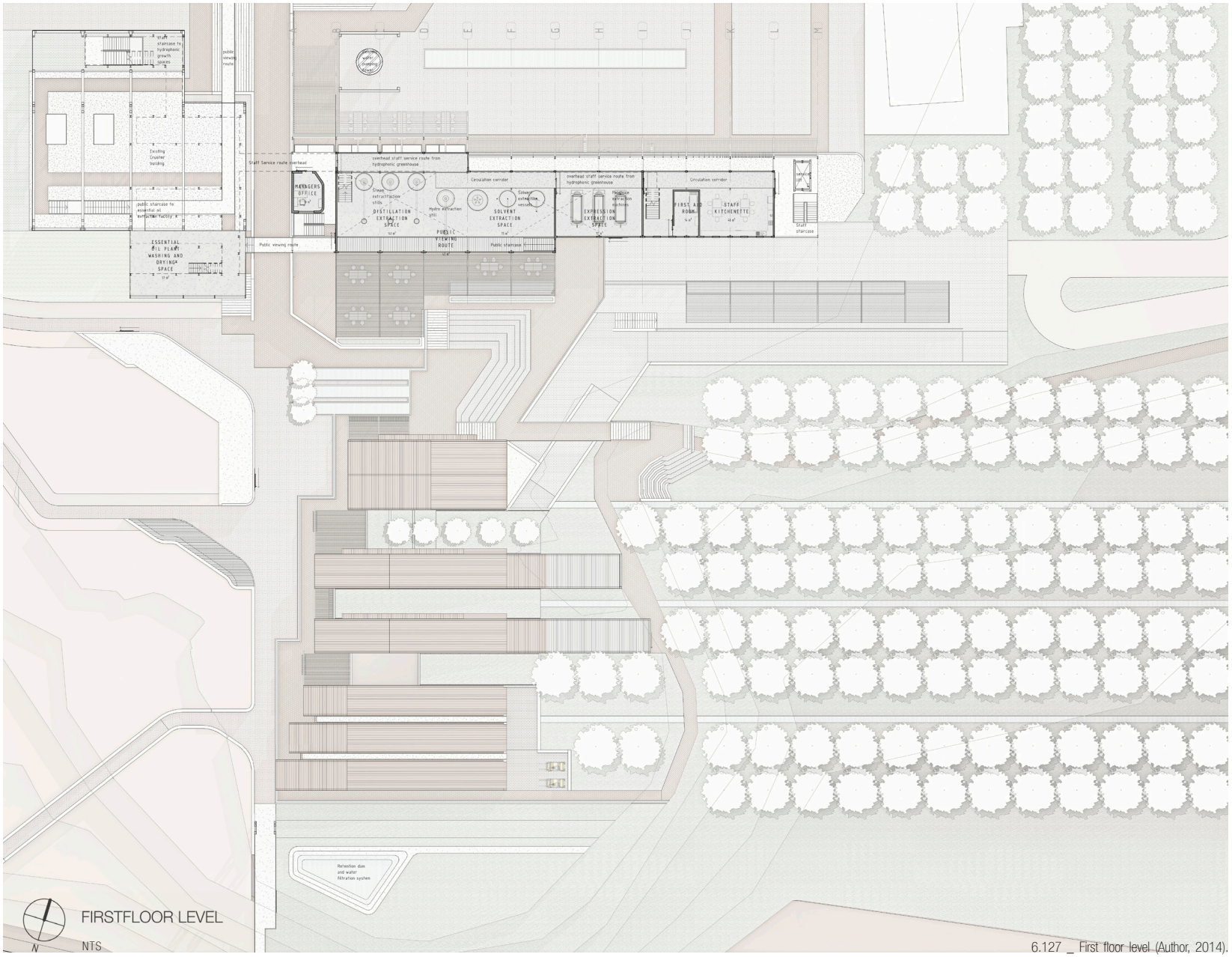
DESIGN ITERATION 3/GROUND FLOOR LEVEL PLAN:



6.126 _ Ground floor level (Author, 2014).

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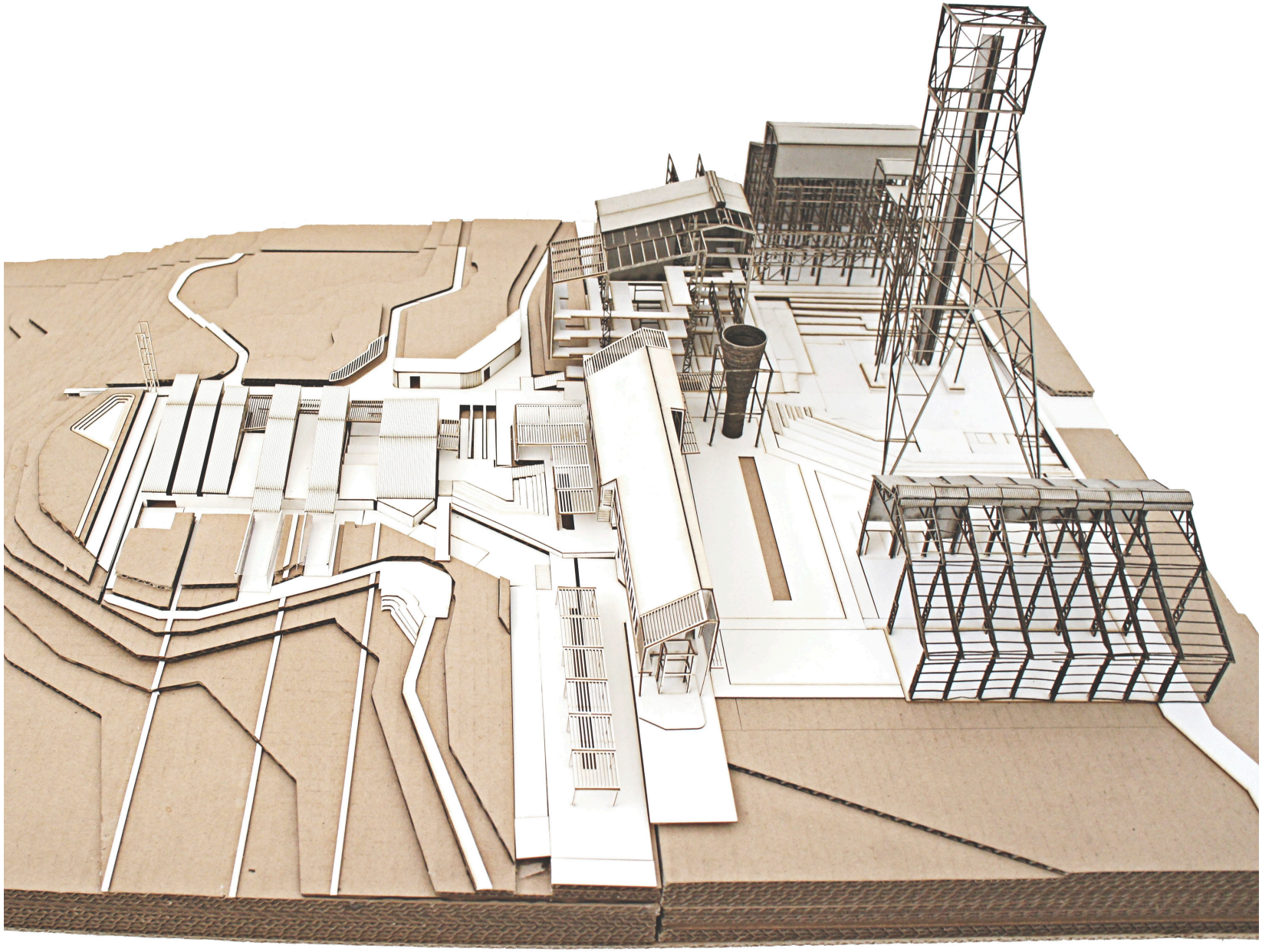
DESIGN ITERATION 3/ FIRST FLOOR LEVEL PLAN:



6.127 _ First floor level (Author, 2014).

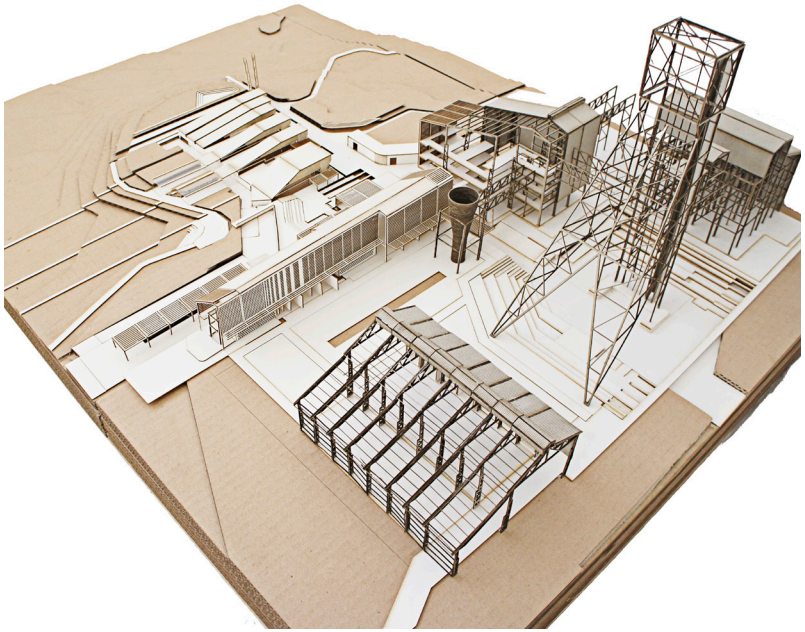
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DESIGN ITERATION 3/ MODEL

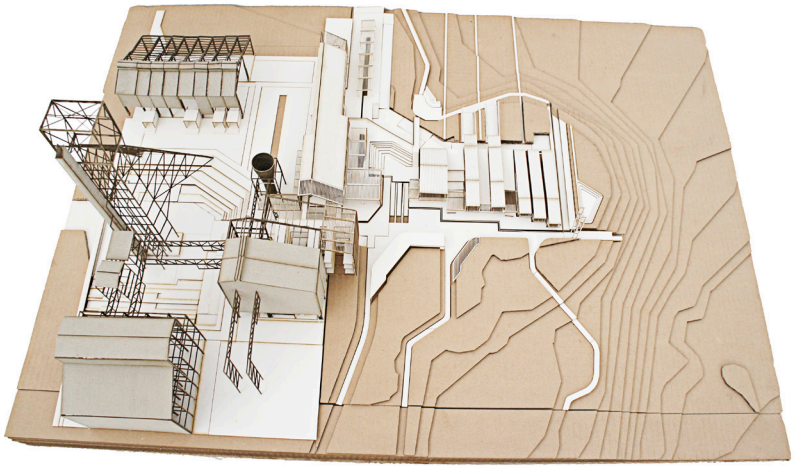


6.128 _ Design iteration 03 model view 01 (Author, 2014).

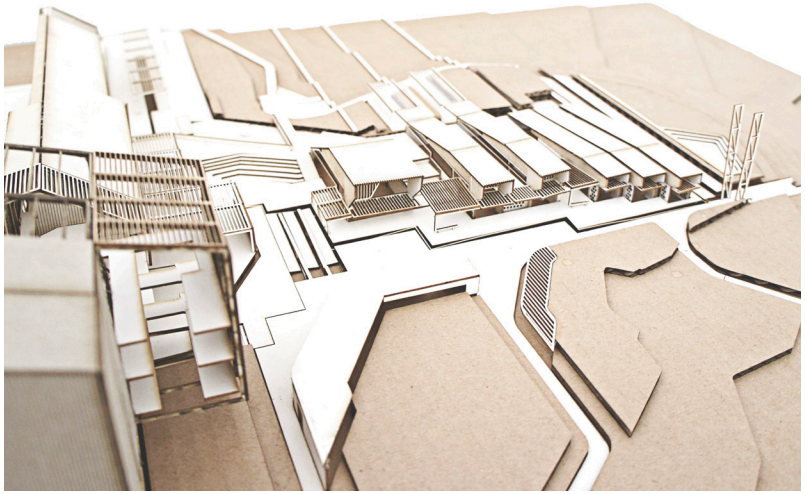
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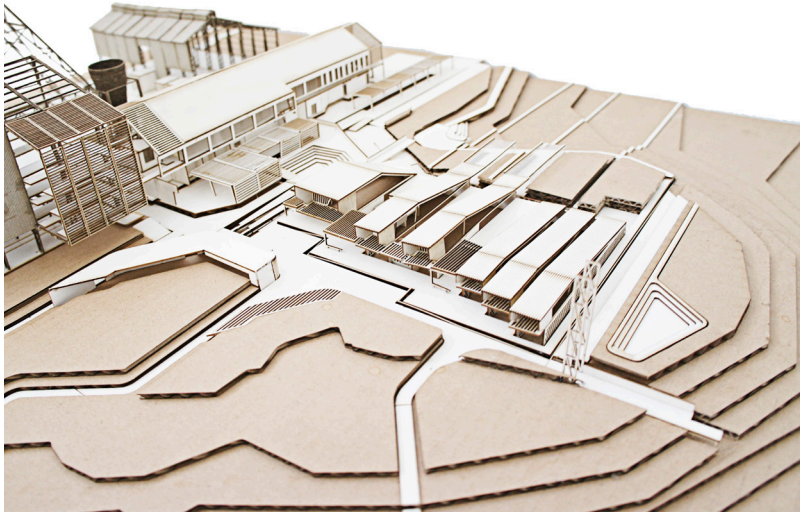
6.129 _ Design iteration 02 model view 02 (Author, 2014).



6.130 _ Design iteration 03 model view 03 (Author, 2014).

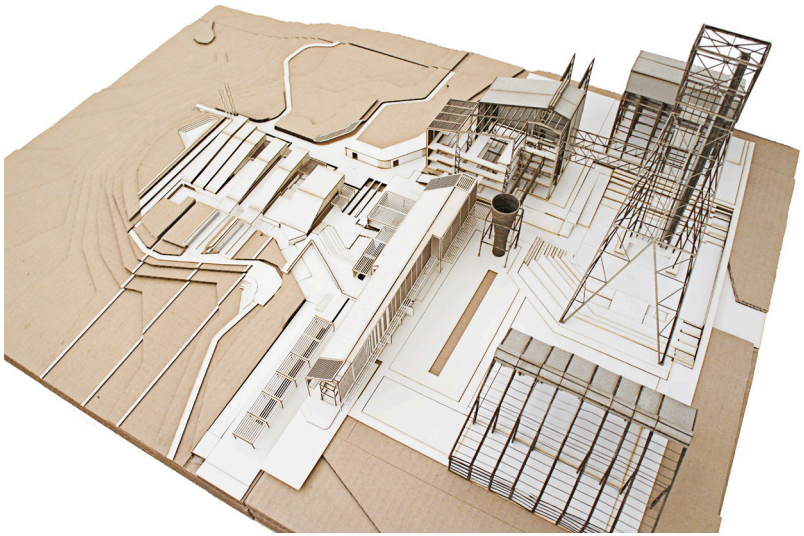


6.131 _ Design iteration 04 model view 02 (Author, 2014).

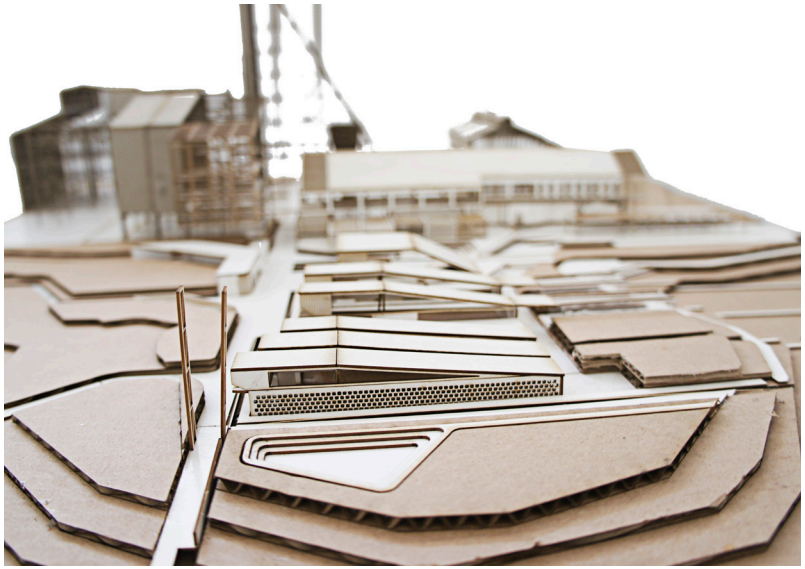


6.132 _ Design iteration 05 model view 04 (Author, 2014).

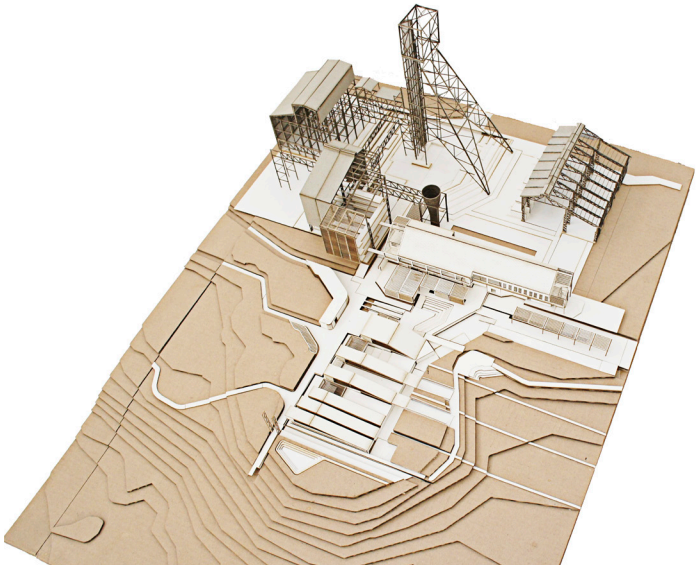
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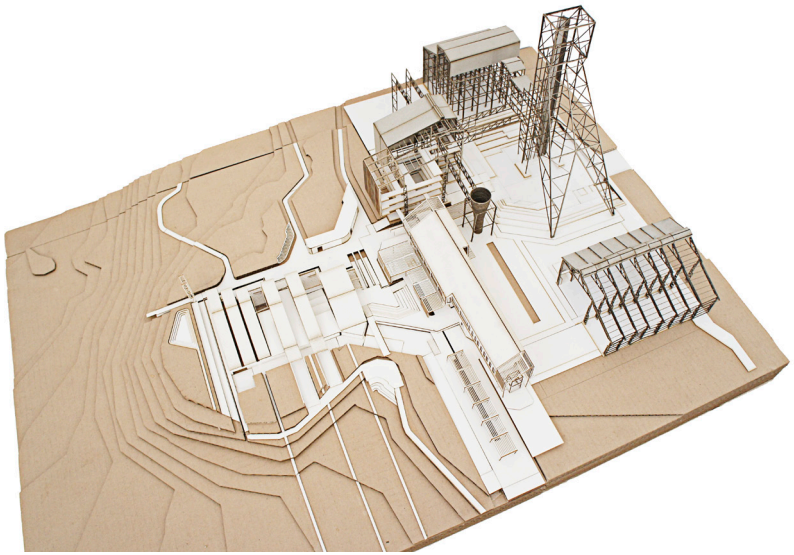
6.133 _ Design iteration 03 model view 06 (Author, 2014).



6.134 _ Design iteration 03 model view 07 (Author, 2014).



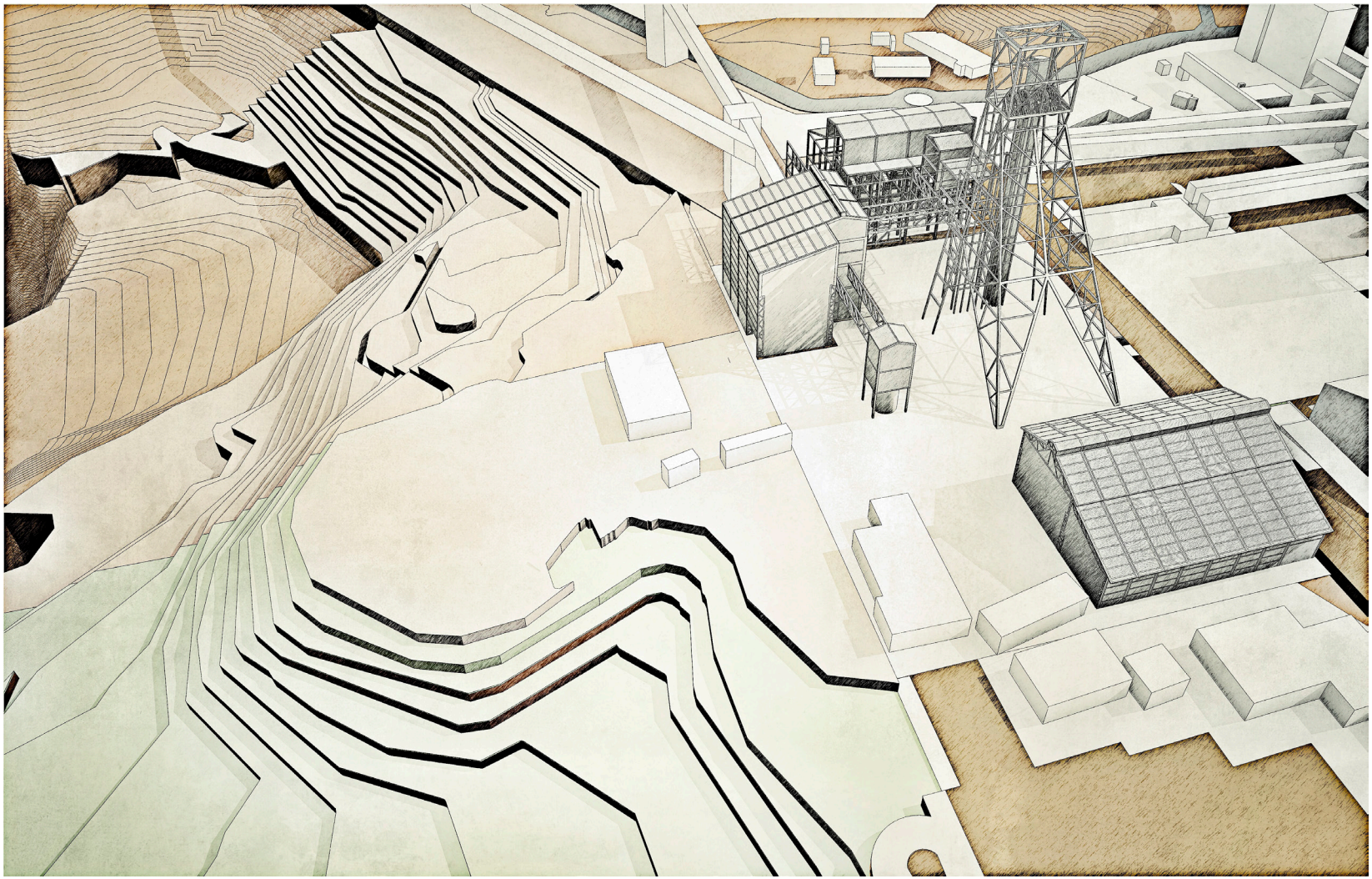
6.135 _ Design iteration 03 model view 08 (Author, 2014).



6.136 _ Design iteration 03 model view 09 (Author, 2014).

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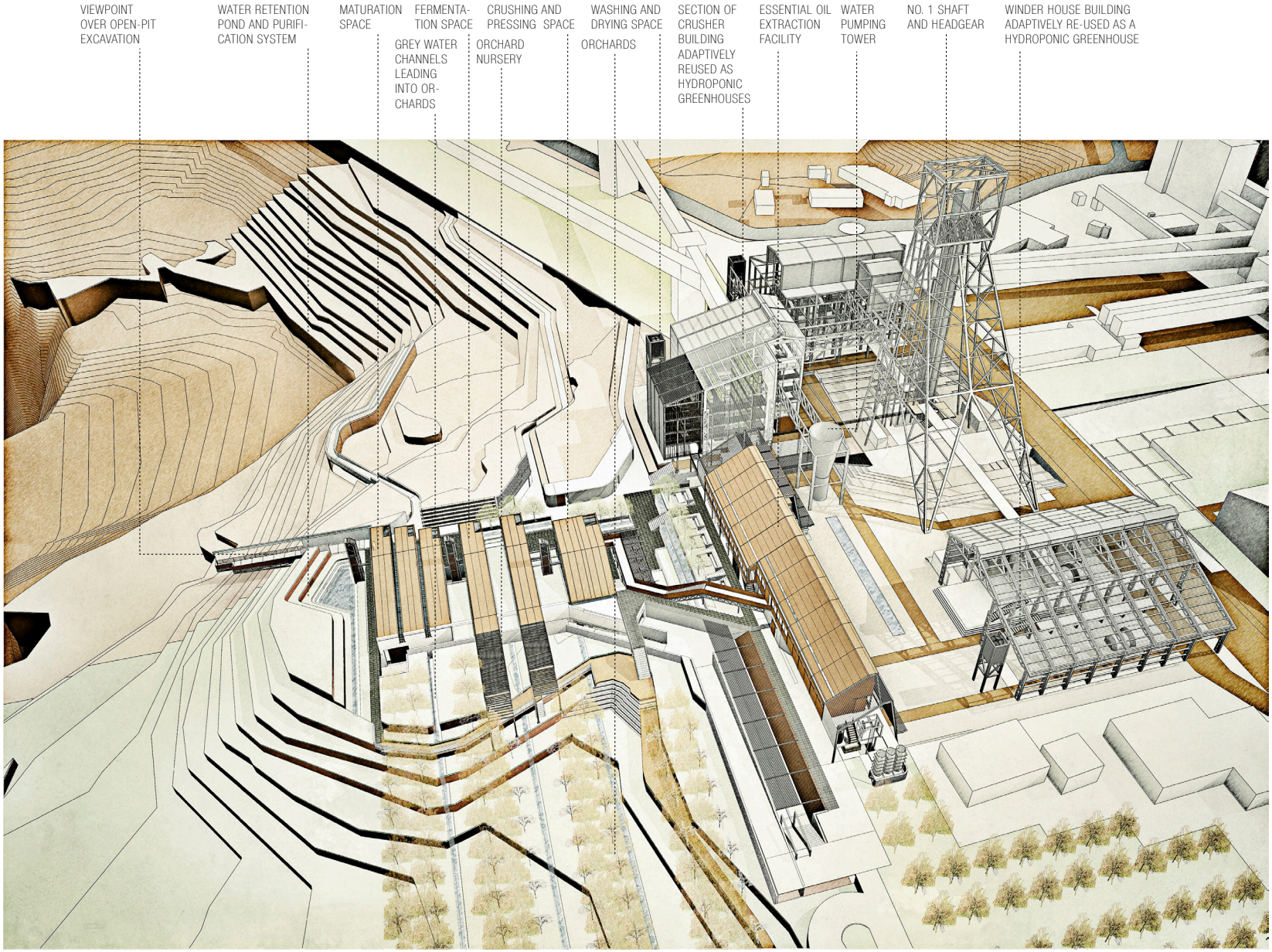
FINAL DESIGN/ BIRDS-EYE VIEW BEFORE PROPOSED INTERVENTION



6.137 _ Birds-eye view before proposed intervention (Author, 2014).

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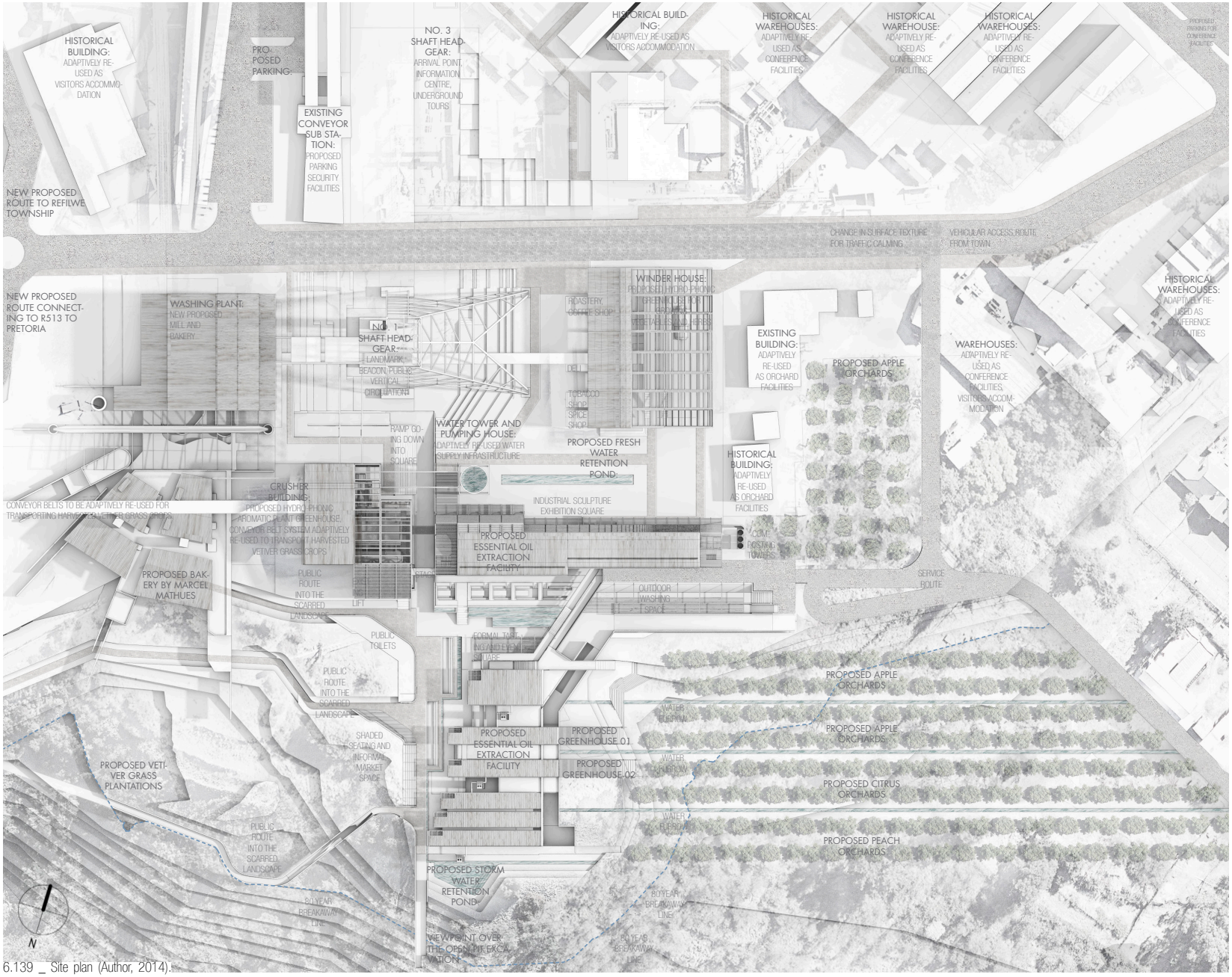
FINAL DESIGN/ BIRDS-EYE VIEW AFTER PROPOSED INTERVENTION



6.138 _ Birds-eye view after proposed intervention (Author, 2014).

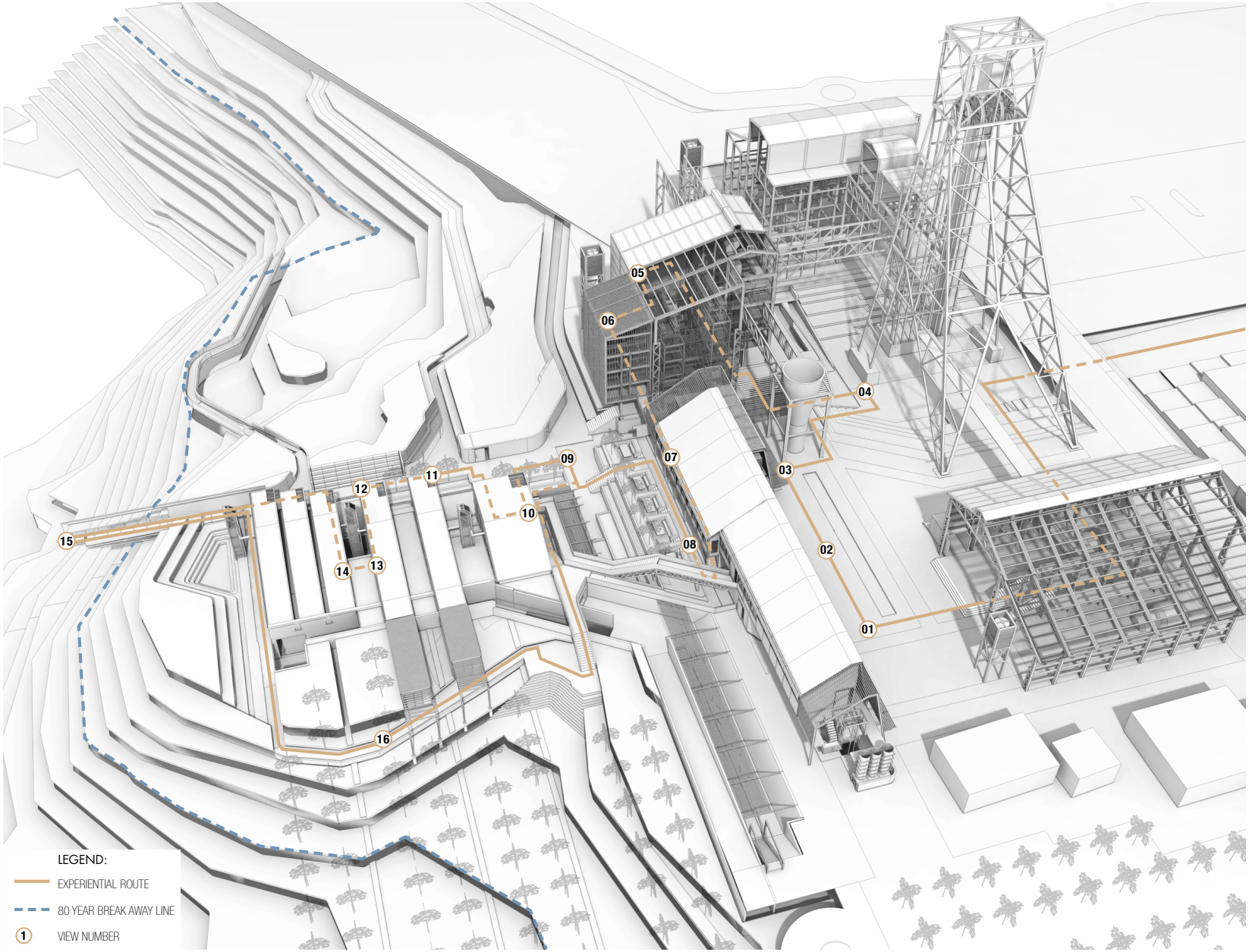
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FINAL DESIGN/ SITE PLAN



6.139 _ Site plan (Author, 2014).

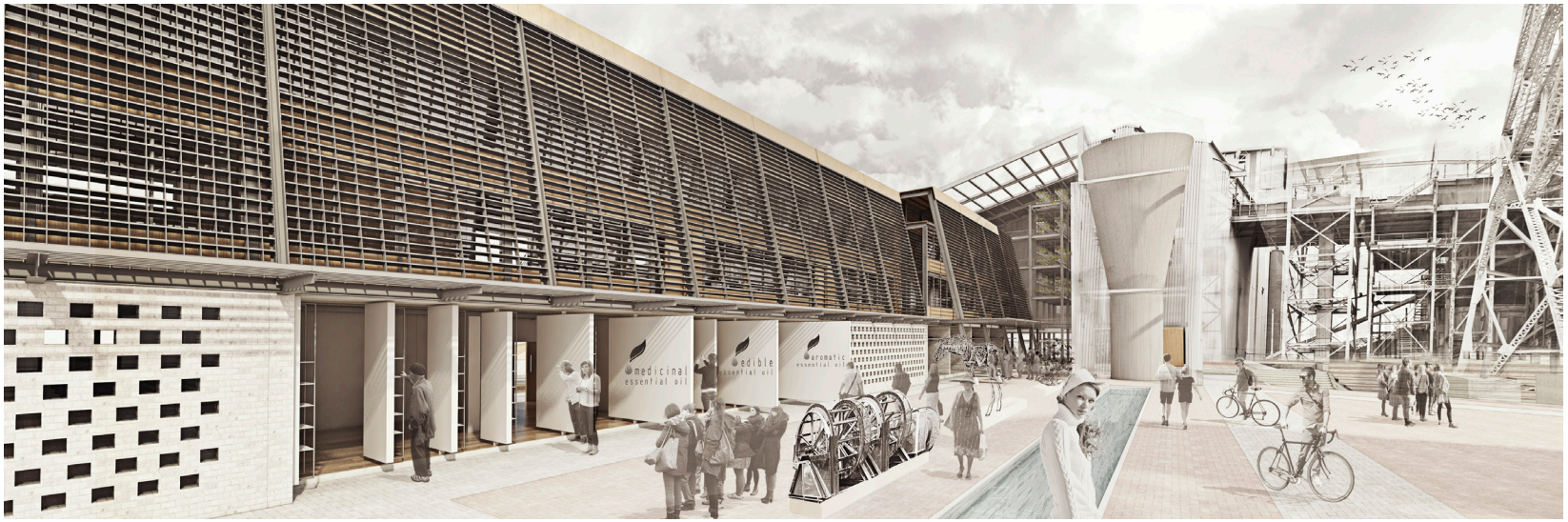
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6.140 _ Experiential promenade showing the views along the route (Author, 2014).

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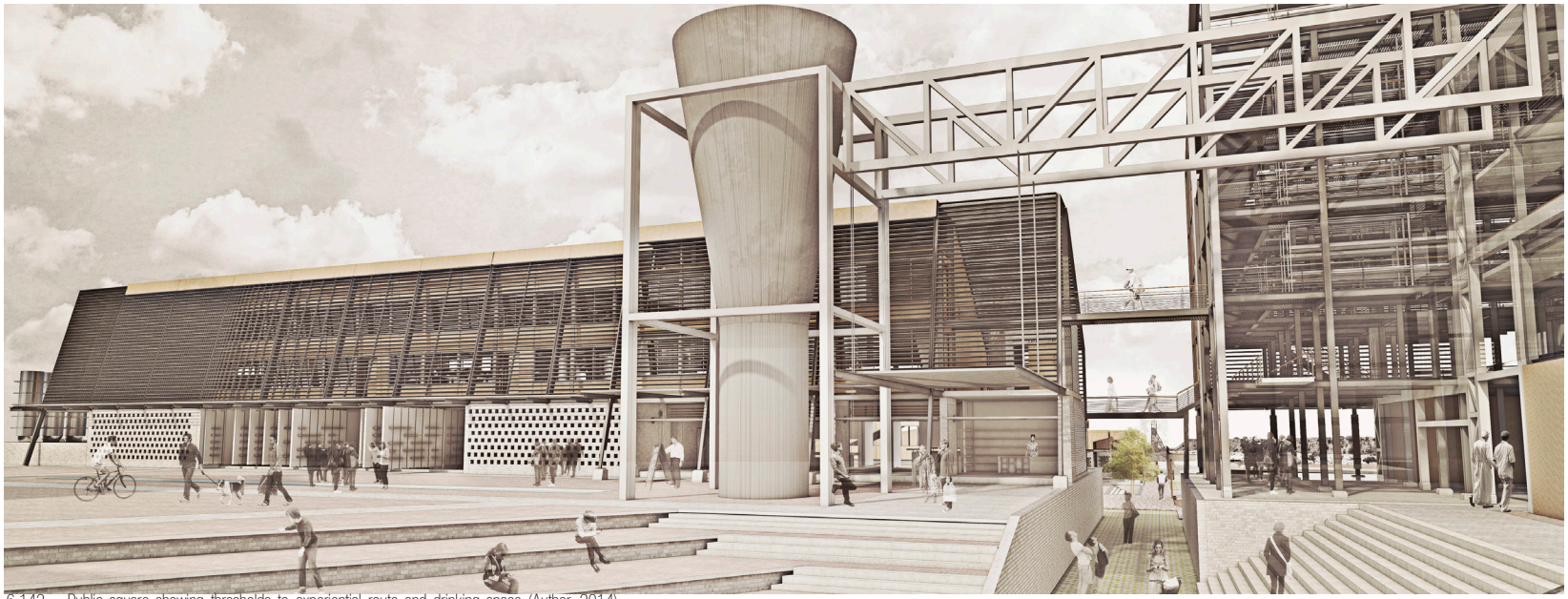
FINAL DESIGN/ **01**_APPROACH



Approaching the essential oil extraction building a protective porous skin wraps the envelope, reminiscent of the sieves used by early miners to extract alluvial diamonds. Direct sunlight is filtered into the interior and the profile of an internal machine becomes visible as it is selectively revealed.

6.141 _ Essential oil retail space with extraction spaces above (Author, 2014).

FINAL DESIGN/ **04**_THE IMMERSION



Traversing along the edge of the essential oil extraction building you are drawn by pleasant fragrances towards an essential oil exhibition and retail space. Swiveling display panels open up to release fragrances and collapse the threshold between public circulation and retail.

6.142 _ Public square showing thresholds to experiential route and drinking space (Author, 2014).

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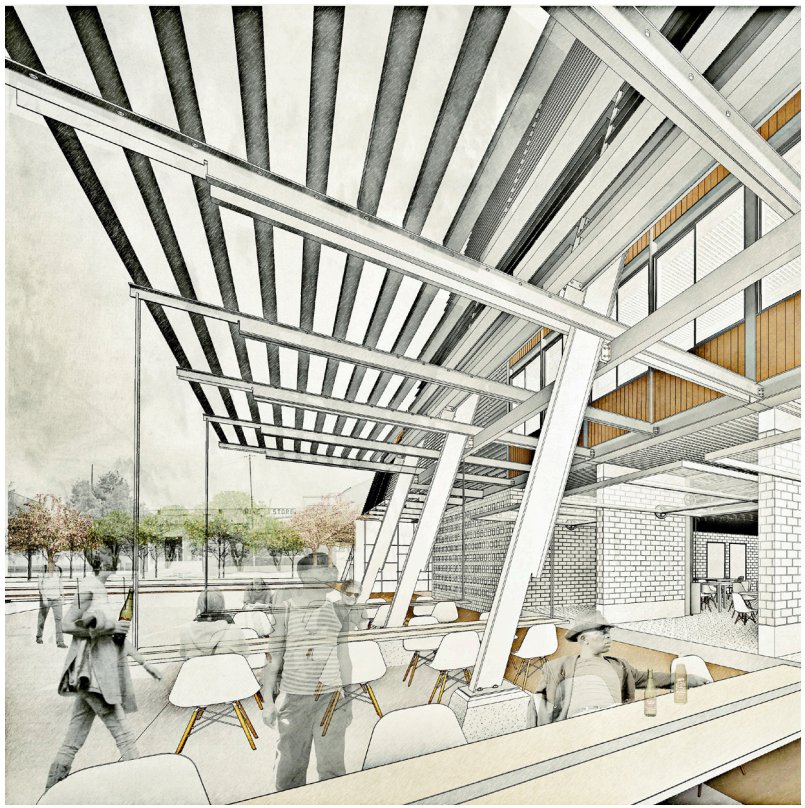
FINAL DESIGN/ **02**_ESSENCE EXHIBITION



6.143 _ Essential oil retail space opening up to collapse the threshold between public circulation and retail (Author, 2014).

Traversing along the edge of the essential oil extraction building you are drawn by pleasant fragrances towards an essential oil exhibition and retail space. Swiveling display panels open up to release fragrances and collapse the threshold between public circulation and retail.

FINAL DESIGN/ **03**_THE DRINKING CANOPY

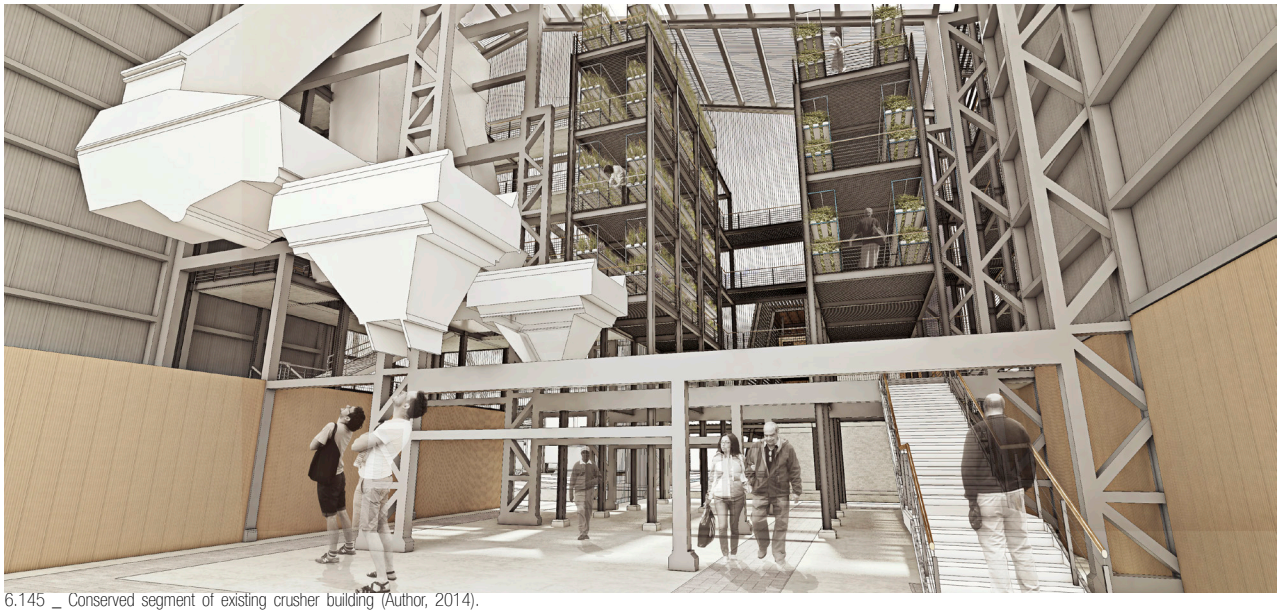


6.144 _ Drinking spaces opening up towards public square (Author, 2014).

Walking beneath the shaded pergola the cider drinking spaces and bar bleeds into the public square. Glass pivot doors open up allowing for a spatial continuity between interior and exterior.

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FINAL DESIGN/ **05**_THE DEATH OF A MACHINE



6.145 _ Conserved segment of existing crusher building (Author, 2014).

Entering the Crusher building the historical chutes and scrubbers project down into the space being conserved as archetypal relics of the past production processes. These relics are conserved and kept intact while being allowed to naturally weather and decay over time contributing to the narrative of the site. In the adjacent space the existing sheeting is replaced with translucent polycarbonate sheeting allowing abundant sunlight to enter from the east. A new lightweight tectonic hydroponic growth structure rises from the floor, pulling itself away from the historical fabric to sit within the voluminous internal space. Traces of new life sprouts from this structure infusing the air with crisp, aromatic fragrances.

FINAL DESIGN/ **06**_REBIRTH



6.146 _ Adaptively re-used segment of crusher building housing washing and drying spaces (Author, 2014).

Ascending into the drying space, streaks of soft sunlight filter through the louvered envelope. A brisk breeze blows though the space carrying a multiplicity of intense aromas which blend to infuse the air with new life.

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6.147 _ Distillation essential oil extraction space along the experiential public route (Author, 2014).

Entering the distillation extraction space along the public route at a slightly lower level, the roof slopes from a lower human scale up towards the double volume sculptural distillation stills. Soft light filters through the porous screen to gently illuminate the interior. Steam gushes forth from the stills and infuses the space with a warm aromatic vapour. When the large sliding windows are opened a breeze rising up from the open pit excavation blows through the space to remove the steam and carry the scents towards the public square.

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6.148 _ Descending from the distilation extraction space towards the formal public event and tasting square (Author, 2014).

Upon descending the stairs of the distillation extraction space one becomes aware of a series of submerged seating spaces, excavated below large shade trees where groups of people enjoy food and cider. The sound of people engaging in pleasant conversation draws ones attention towards the tasting and event space below. A series of planted terraces and flowing water channels step down towards this space which is nestled between landscape and building.

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6.149 _ Public circulation along the experiential promenade as a living scar within the waste rock dumping site (Author, 2014).

Descending further towards the public promenade it becomes a living incision made into the waste rock dumping site from which new life sprouts in the form of submerged gardens, fruit trees and a network of water channels. Visitors walk down into the submerged gardens to recline under the shade of the trees or embark on a journey into the scarred landscape along various routes. Others descend along the axis towards the viewpoint over the open-pit excavation which looms in the distance. Groups of spectators gather in the various buildings along the edge of the promenade.

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6.150_ The crushing, pressing and unfermented juice tasting space (Author, 2014).

Upon entering the crushing and pressing space the sweet aroma of freshly pressed fruit permeates the air. A low grumbling sound is emitted from the fruit crusher which crunches the soft, ripe flesh of the fruit into a fluffy paste. The cider press groans and creaks as it presses down on the crushed fruit until fresh juice flows from the spout as a golden liquid. The space is alive with activity as groups of people excitedly await to taste the freshly pressed juice.

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FINAL DESIGN/ **11**_THE EXPERIENTIAL PROMENADE



Numerous people move along the experiential promenade, with groups of people gathering and conversing on various levels within the tasting spaces or on the balconies above. The cider making facility establishes a defined public edge to the promenade to contain the energy and direct the flow of people. The experience progresses from a collective diversity to a focused individual experience as the route becomes narrower towards the viewpoint.

6.151 _ The public edge established by the cider-making facility becomes an experiential route towards the viewpoint (Author, 2014).

FINAL DESIGN/ **12**_THRESHOLDS



A series lightweight steel roofs gradually slope out of the landscape to define different thresholds into the various tasting spaces of the cider-making facility along the public promenade. The space is alive with activity as children play in the water channels and students drink cider on the balconies overlooking the reclaimed post-industrial mining landscape.

6.152 _ Lightweight steel roofs gradually sloping out of the landscape to establish a series of thresholds leading towards the various tasting spaces (Author, 2014).

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FINAL DESIGN/ **13**_FERMENTATION



6.153 _ Fermentation space showing elevated public viewing route with production below (Author, 2014).

The fermentation space is pleasantly cold being provided with a sense of warmth through the continuous copper ceiling which stretches along its length. A strip of glazing penetrates the copper ceiling to bring in soft, indirect southern light which illuminates the polished fermentation vessels. A strong scent of fermented fruit drifts along the space towards the ventilation ducts where it is drawn out. The flow of liquid can be heard coming from the channels below as a primary fermentation vessel is drained to be racked off. A group of workers below are tinkering with equipment, conducting tests and sweeping the liquid on the floor into the floor channels.

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FINAL DESIGN/ **14**_MATURATION



6.154 _ Maturation space showing elevated public viewing route with production below (Author, 2014).

A rich , sweet smell fills the air of the maturation space blended with the deep scent of the old oak barrels. The space is reverently silent as if not wanting to disturb the aging content of the enormous maturation barrels. Soft light is reflected down from the copper ceiling into the space below. In some parts the copper ceiling is starting to show signs of aging, as if be connected to the maturation process below.

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6.155 _ The viewpoint over the open-pit excavation (Author, 2014).

A warm breeze rises from the open pit excavation as its unearthly depth and scale pulls the viewers in. It is hard to imagine that man is simultaneously capable of such grandeur and destruction. A heightened experience creates a greater awareness of the impact of industry on the landscape and allows one to reflect on the historical exploitation of nature.

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6.156 _ The greenhouses stretching towards the orchards (Author, 2014).

Walking down the route adjacent to the orchards, the greenhouses stretch into the landscape becoming fragmented and transparent. The sound of flowing water drifts into the surroundings as purified water and nutrients is conveyed from the cider-making facility along the furrows back into the landscape, sustaining it and providing it with a means for new life. Industry is reconciled with nature as it establishes a mutualistic interdependent relationship with its natural surroundings. New saplings are taken from the greenhouses into the orchards, initiating the rebirth of the post-industrial scarred environment.

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007

CHAPTER 07 / A CONSTRUCTIVE MINING AFTERMATH _

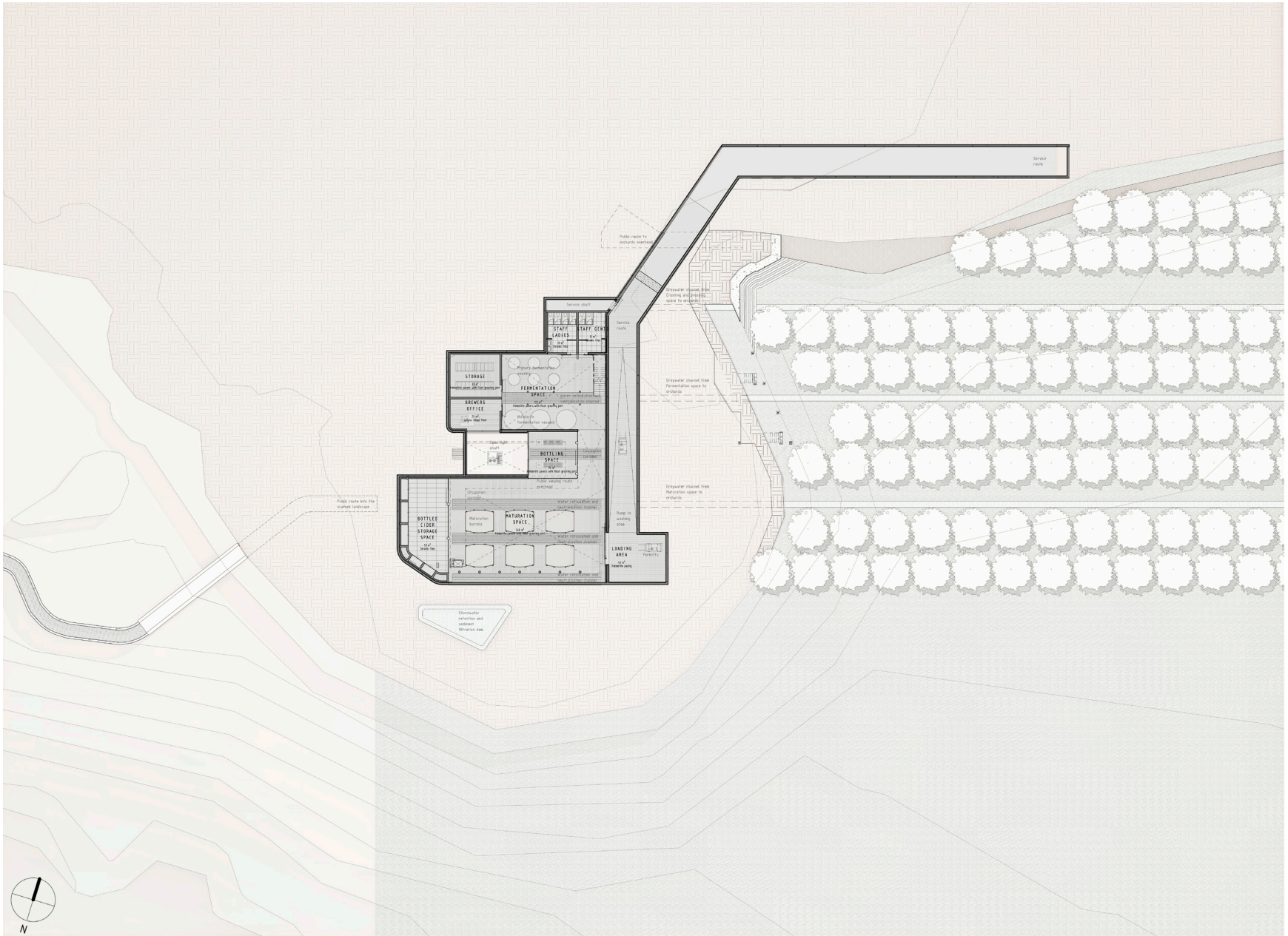
Design and technical resolution



(Author, 2014)

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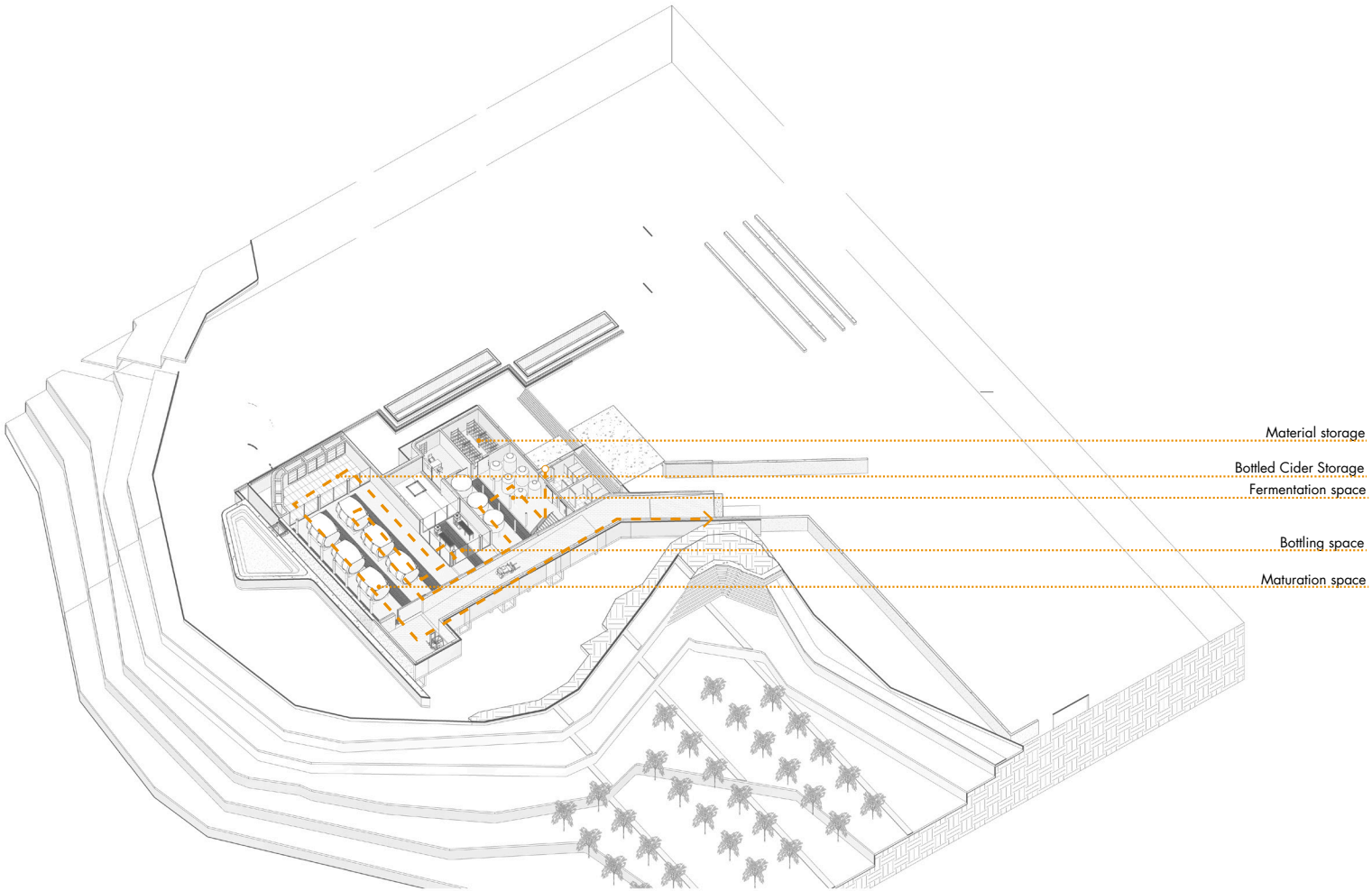
FINAL DESIGN/ FERMENTATION LEVEL PLAN



7.2 _ Fermentation level (Author: 2014).

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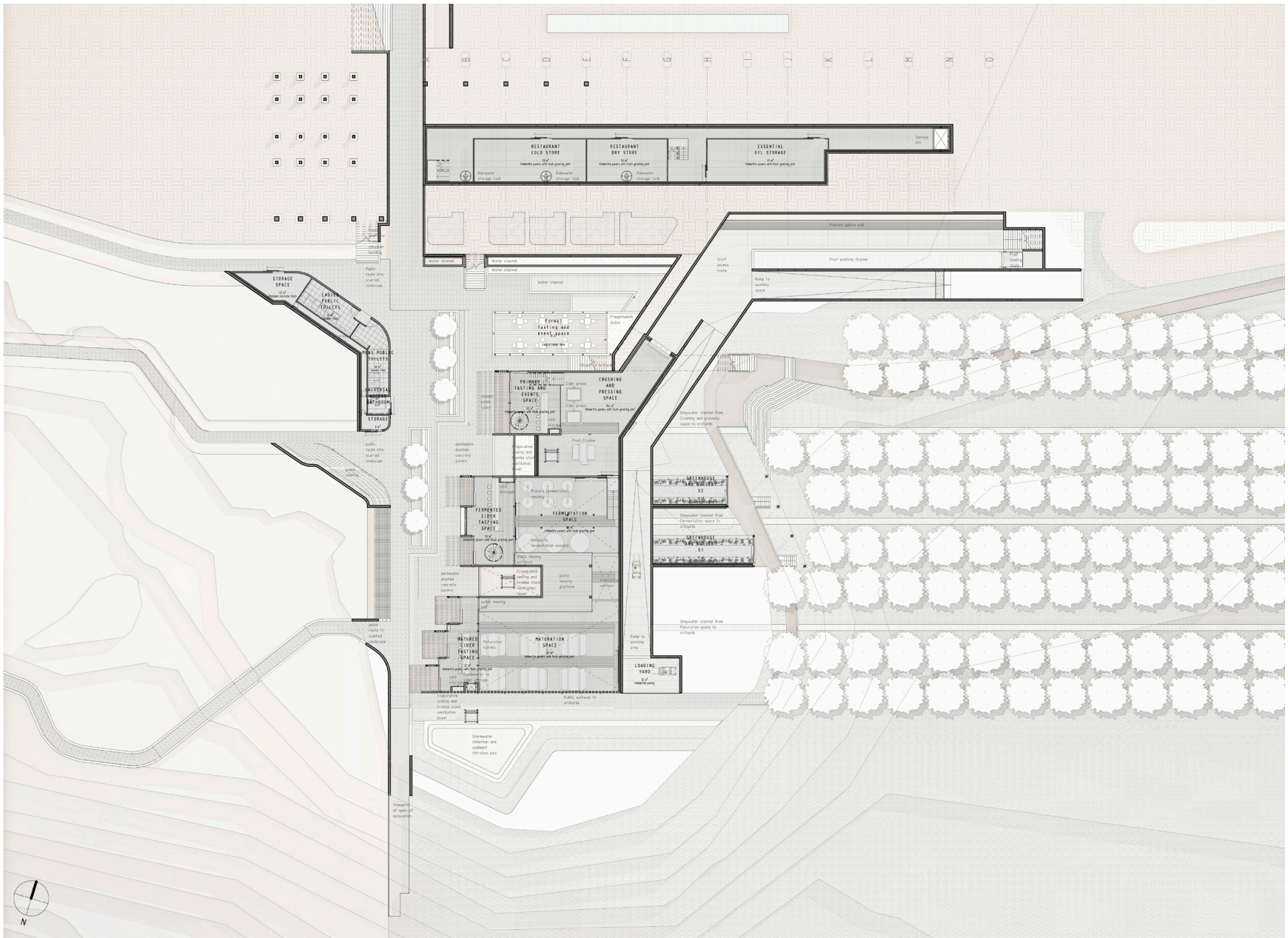
FERMENTATION LEVEL MOVEMENT/ PRODUCTION PROCESSES



7.3 _ Diagram showing production processes and the flow of raw material on the fermentation level of the cider-making facility (Author: 2014).

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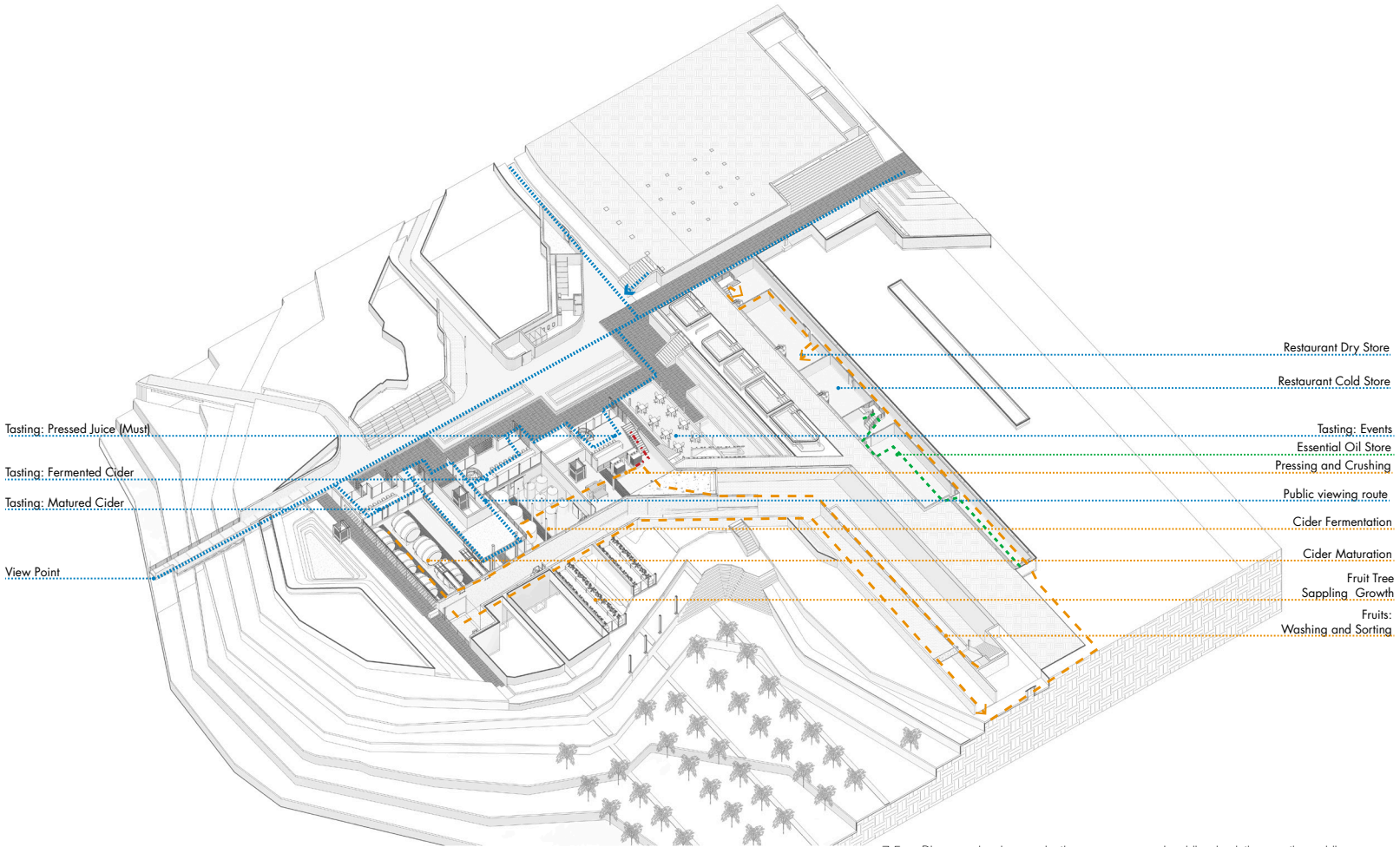
FINAL DESIGN/ PUBLIC SQUARE LEVEL PLAN



7.4 _ Public square level (Author: 2014).

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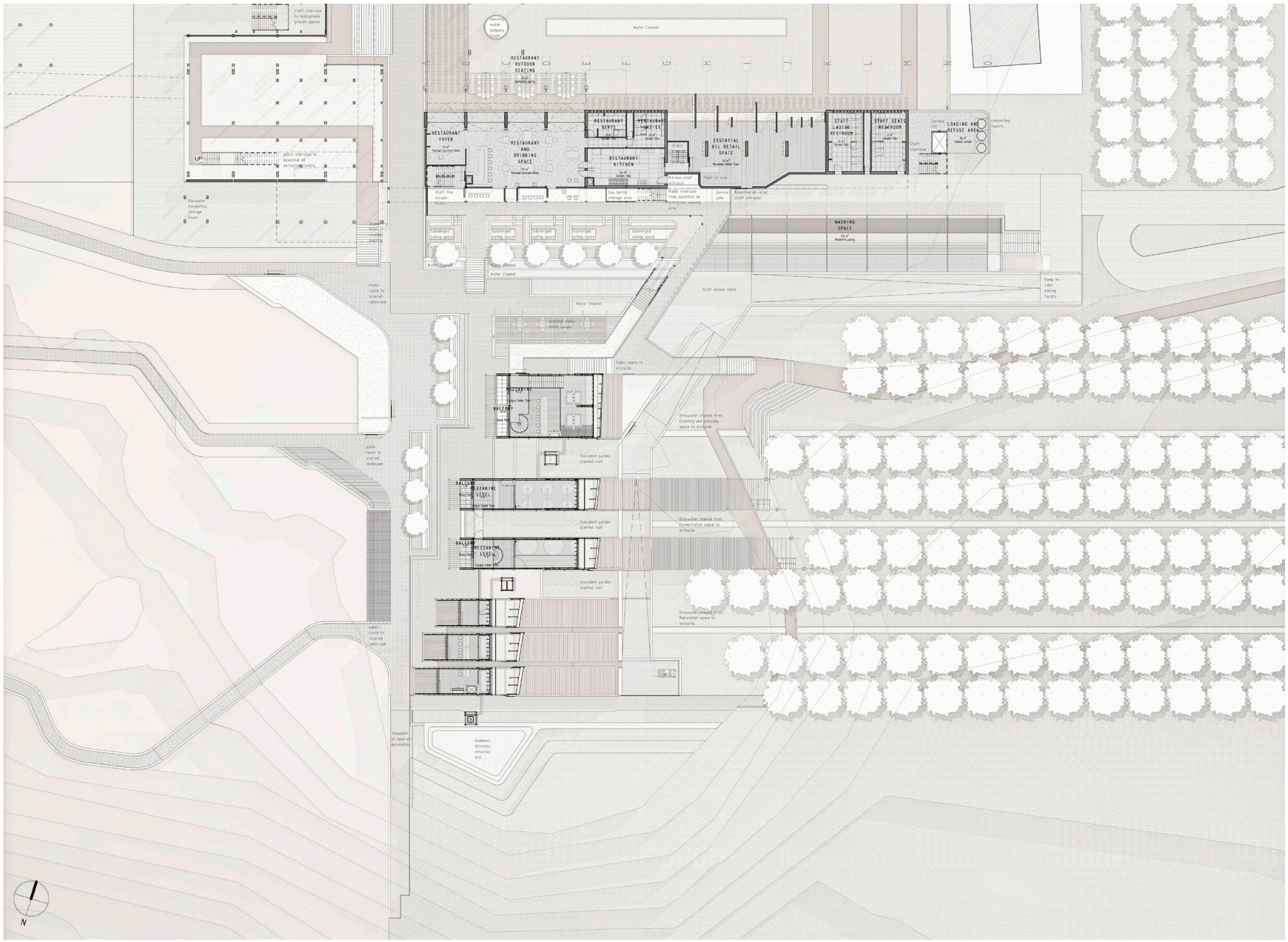
PUBLIC SQUARE LEVEL MOVEMENT/ PUBLIC CIRCULATION AND PRODUCTION PROCESSES



7.5 _ Diagram showing production processes and public circulation on the public square level of the cider-making facility and the essential oil extraction facility (Author: 2014).

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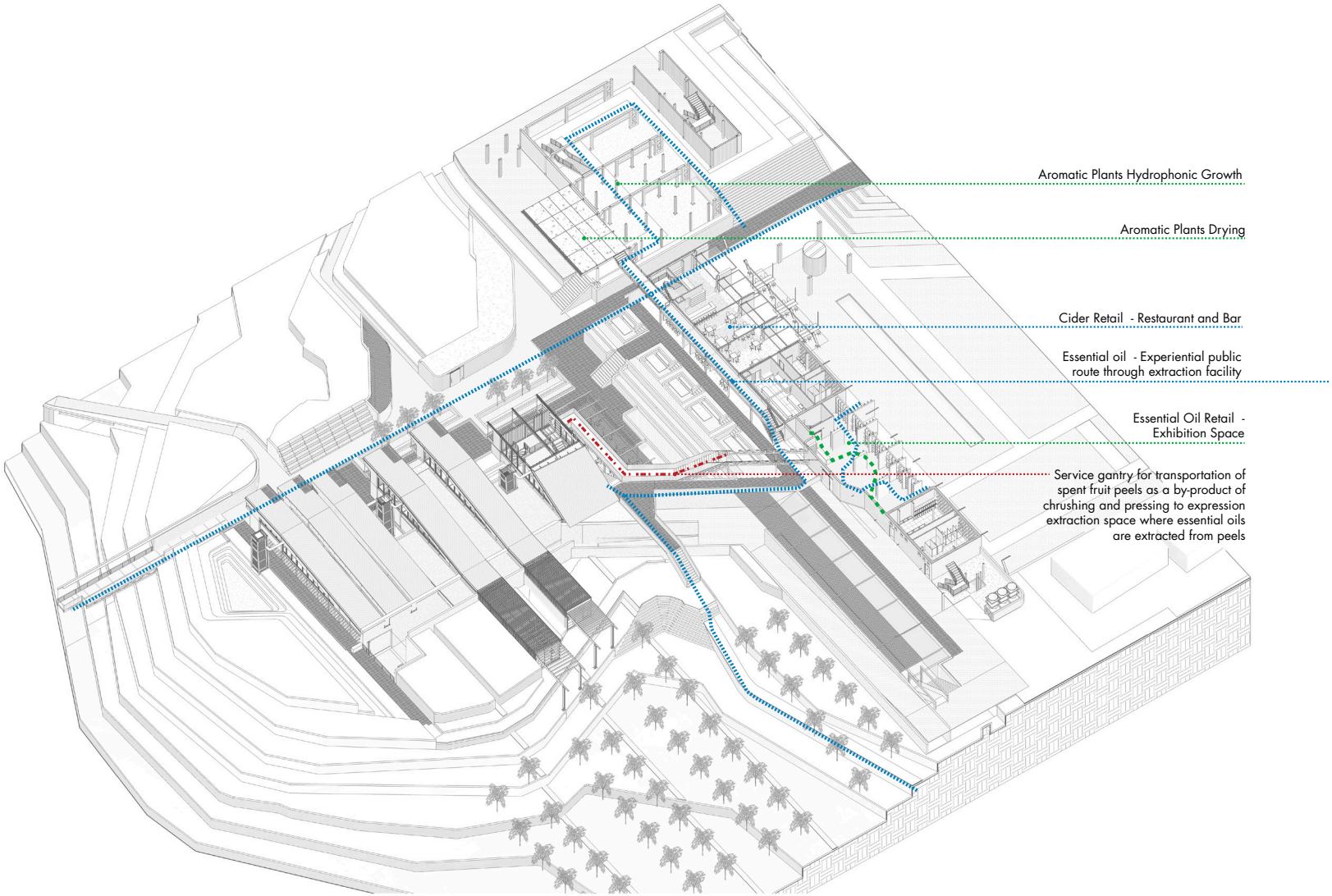
FINAL DESIGN/ GROUND FLOOR LEVEL PLAN



7.6. Ground floor level (Author: 2014).

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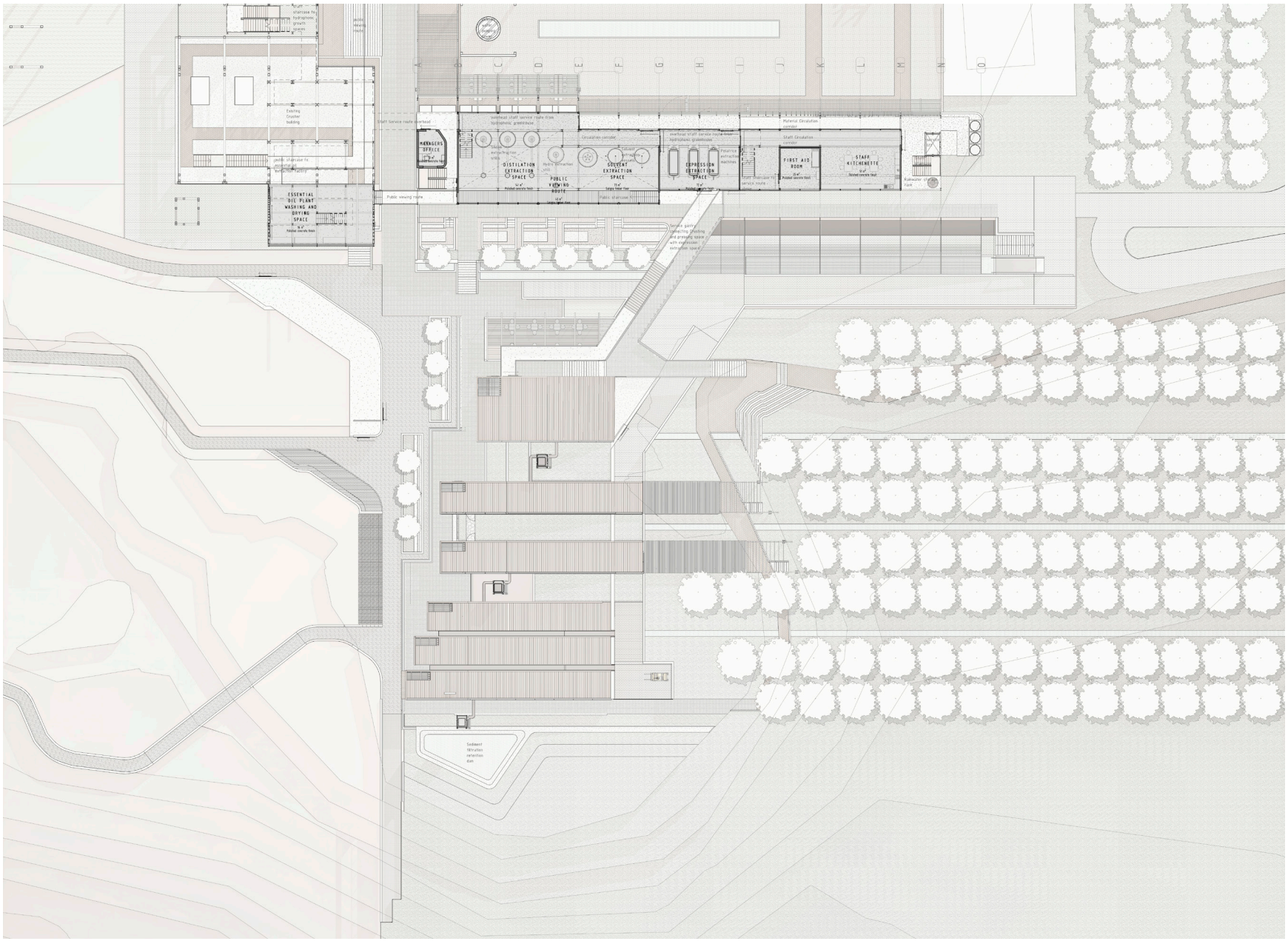
GROUND FLOOR LEVEL MOVEMENT/ PUBLIC CIRCULATION AND PRODUCTION PROCESSES



7.7. Diagram showing production processes and public circulation on the ground floor level of the cider-making facility and the essential oil extraction facility (Author: 2014).

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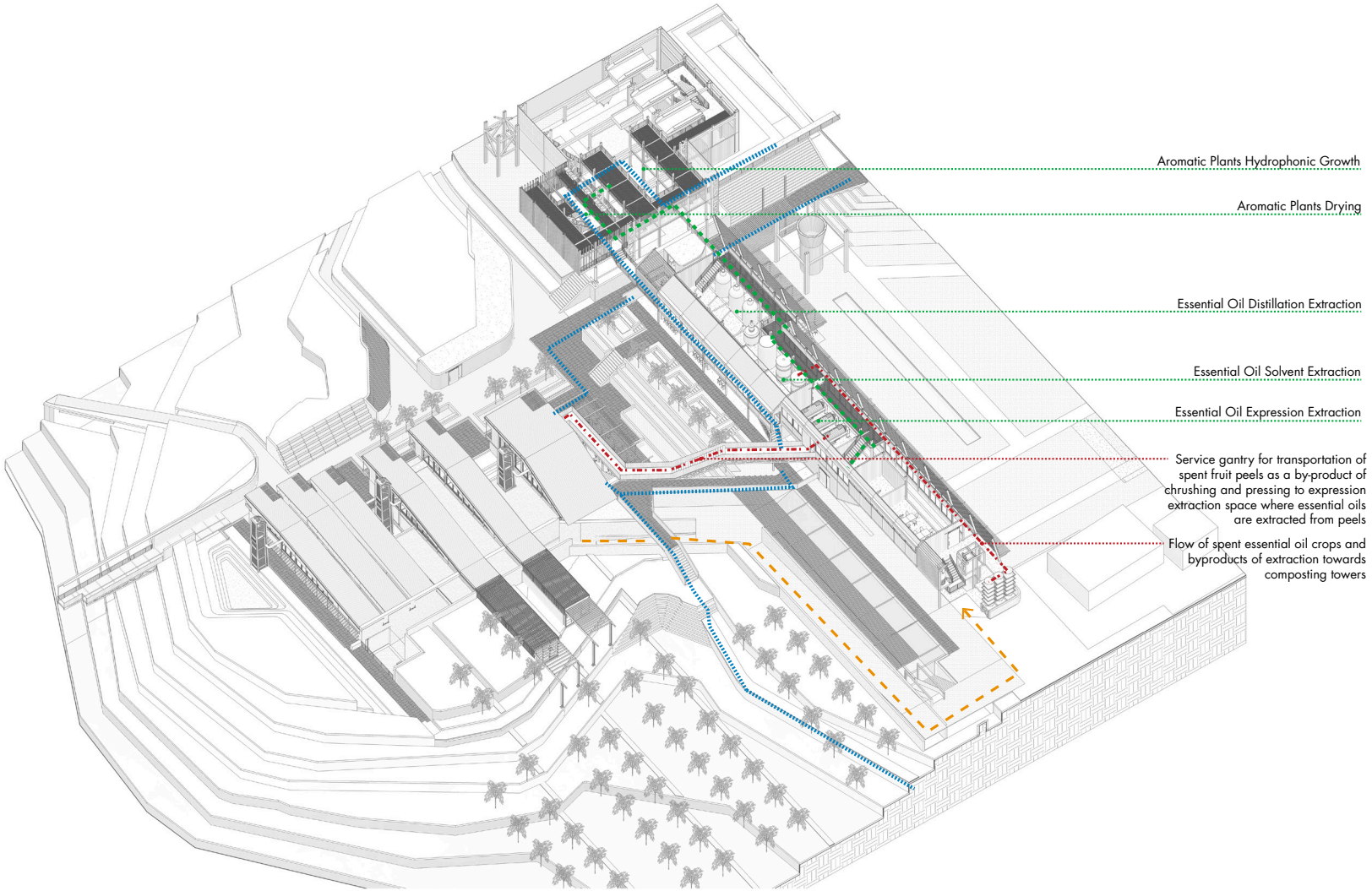
FINAL DESIGN/ FIRST FLOOR LEVEL PLAN



7.8 _ First floor level (Author: 2014).

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FIRST FLOOR LEVEL MOVEMENT/ PUBLIC CIRCULATION AND PRODUCTION PROCESSES



7.9 _ Diagram showing production processes and public circulation on the first floor level of the cider-making facility and the essential oil extraction facility (Author: 2014).

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7.10 _ Showing the architectural dichotomy exists between built fabric and landscape at the Cullinan mine. (Lincoln: 2011, edited by author).

TECHNICAL RESOLUTION/ 007

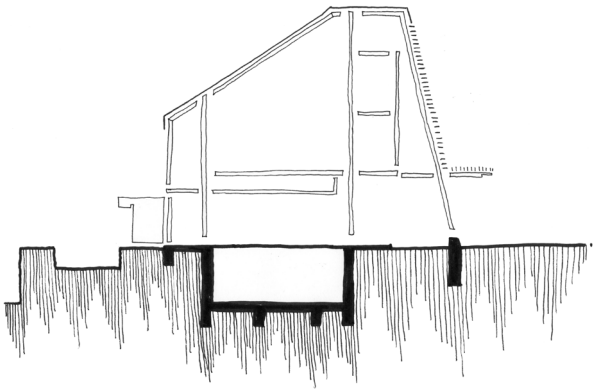
INTRODUCTION:

A significant architectural dichotomy exists between built fabric and landscape at the Cullinan Diamond Mine **(Figure 7.8)**. The post-industrial environment is made up of various structures with industrial heritage significance, a scarred landscape, and a natural landscape. Transitions between these conditions are ambiguous and undefined. This notwithstanding, each of these conditions has spatial and architectural significance contributing to the meaning, understanding and collective heritage significance of the site. The proposed architecture will define and delineate the existing individual spatial identities while reconnecting them through an experiential promenade. The proposed intervention consists of two primary components, namely the essential oil extraction facility and the cider-making facility. The essential oil extraction component will establish a new relationship with the extant industrial heritage, while the cider-making component will investigate a synergy between industry and the landscape. Design and the art of making are inseparable, being an extension of one another with no segregating boundaries or clear distinction between them; therefore, in the following chapter the technical resolution of the proposed intervention is perceived and approached as a continuation of the design process on a detail level. The purpose of this chapter is not to produce contract documentation, but rather to communicate the development of tectonic ideas, to explore and unravel the potential of tectonics to convey meaning, and to get lost in the delight of detailing.

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7.11 _ Showing the expressed bolted connections of the No.1 Shaft and headgear (Lincoln: 2011, edited by author).



7.12 _ Diagram showing the tectonic concept of constructive extraction within the essential oil extraction facility (Author: 2014).

TECTONIC CONCEPT/

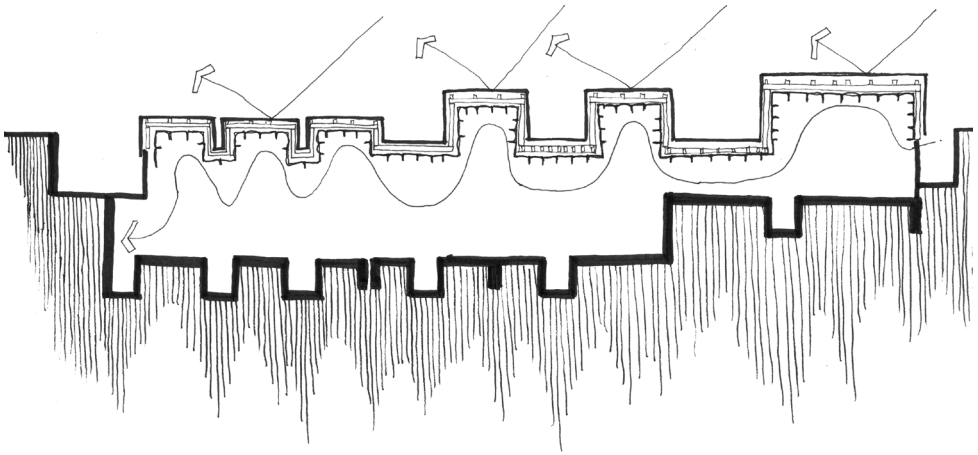
The tectonic concept postulates three approaches to both industrial and landscape heritage by building on the intentions of the conceptual design approach and employing the tectonic concepts of constructive extraction, reinsertion and reconciliation.

CONSTRUCTIVE EXTRACTION/

The tectonics of the essential oil extraction facility are based on the concept of extraction, which draws on the typology, materiality and detailing of the surrounding industrial context. It then either reflects this condition or transforms its principles to meet the requirements of the proposed industry and the experiential interface between public experience and industrial production. The act of extraction is associated with deducing principles, construing meaning, drawing from, and isolating. The existing industrial typology of a heavy masonry base and concrete floors with a steel portal frame and lightweight envelope forms the basis for the proposed architecture. As shown in **Figure 7.12,** a heavy subterranean base becomes the anchor of the new building, tying it into the landscape and forming the foundation of the lightweight envelope above. This lightweight envelope consists of various individual parts or components, as shown in **Figure 7.12,** which each has its own identity, but simultaneously contributes a critical element to the envelope as a whole, forming a collective. While responding to the character of the bolted connections of the extant No. 1 Shaft and Headgear (see **Figure 7.11**), a series of expressed and exposed structural connections creates a new tectonic character, without losing the individual identity of the constituent parts.

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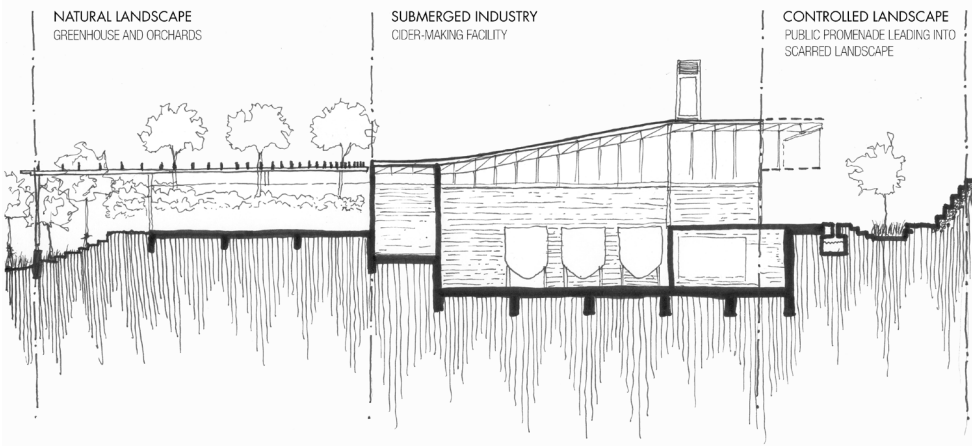


7.13 _ Diagram showing the tectonic concept of reinsertion within the cider-making facility (Author: 2014).

REINSERTION/

The tectonic language of the cider-making facility reflects the concept of reinsertion, achieved through the excavation of the scarred landscape which currently exists as a waste-rock dumping site, and the reinsertion of a protective stereotomic shell to create functional underground spaces (see **Figure 7.13**). A continuity of surface and materials enhances the cavernous quality of the subterranean spaces while providing spatial continuity (see **Figure 7.13**). The concept of reinsertion is further expressed through structural components which are inserted into and concealed between protective external and internal skins. These skins are constructed of an insulating, durable and hard-wearing surface externally, and a homogeneous, slow weathering surface internally, and build up a protective but ever changing surface informed by the internal processes of fermentation and maturation.

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7.14 _ Diagram showing the tectonic concept of reconciliation within the cider-making facility (Author: 2014).

RECONCILIATION/

The tectonic concept for the cider-making facility aims to reconcile the scarred landscape, the industrial structures and the natural landscape, as shown in **Figure 7.14.** This will be achieved by establishing a new mutualistic relationship between landscape and industry. The location of lightweight planted timber roofs draws the natural landscape in from the orchards towards the public promenade, which is located adjacent to the scarred landscape and exists as a controlled landscape. These planted roofs function as low-maintenance succulent gardens harvested for essential oil extraction. A gradual progression from a controlled landscape to the submerged industry to the natural landscape is expressed in the use of materials and the tectonic character of the cider-making facility. Using materials in this way conveys the narrative of a new mutually beneficial relationship between industry and the landscape.

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7.15_ Showing the existing material palette within the mine (Author: 2014).

EXISTING MATERIAL PALETTE AT THE MINE AND IN THE SURROUNDING AREA

The existing mining structures consist of materials which express a particular industrial character and aesthetic as shown in **Figure 7.15.** The nature of these materials contributes to the unique ambiance and the industrial atmosphere of the site as a whole. It becomes apparent that the selection of the existing materials used for the mine were predominantly based on two principles, namely:

• Structural and functional capabilities related to the ability to withstand tensile and compressive forces, carry loads, and allow for rapid assembly and construction. This is achieved by means of pre-manufactured components or parts that are bolted or riveted together on site.

• Robust, durable and hard-wearing characteristics which minimize maintenance requirements resulting from natural entropy and decay, as well as withstand the wear and tear they are subjected to during industrial processes.

Despite the fact that these materials were selected for their durability, they did eventually start to weather and decay over time, contributing to the ever-changing narrative of the site. Being primarily informed by functional, economic and production requirements, the existing industrial materials lack a diversity in haptic and tactile qualities, resulting in a homogeneous industrial environment which limits and restricts the spatial and sensory experience of the visitor.

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7.16 _ The kimberlite tailings at the mine (Author: 2014).



7.17 _ Callie Botha and his team (Lincoln 2014, edited by author).



7.18 _ Kimberlite clay bricks (Author: 2014).

FROM WASTE TO WORTH/ THE MAKING OF A UNIQUE CLAY BRICK:

From 2009 to 2010 Callie Botha, in association with the South African Council for Geo-science, developed and patented a method to manufacture clay bricks using kimberlite mine tailings and slimes obtained from the Cullinan Diamond Mine (see **Figure 7.16**). Since then the mine has invested R6,1 million in this project. As required by law, an environmental impact assessment is currently in process before the manufacturing plant, which has already been purchased, can be commissioned and assembled. (Angel Investment Network: 2014)

Callie Botha, shown in **Figure 7.17,** has set up two successful brick-making plants in the North West Province – in Zeerust, and between Swartruggens and Koster. Andalusite tailings and slimes, which possess similar characteristics to those of kimberlite, are currently being used to manufacture clay bricks at these sites. The plant at Swartruggens has the capability to produce approximately 500,000 bricks per month, and the plant at Zeerust can produce 1,000,000 bricks per month. The current demand for these clay bricks from as far afield as Rustenburg exceeds supply. (Angel Investment Network: 2014)

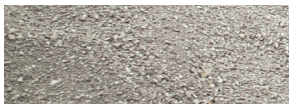
Additionally, these brick manufacturing plants employ the Habla zigzag kiln, which is significantly more environmentally friendly and effective than traditional clamp systems. The planned brick-making plant at Cullinan therefore has the ability to rehabilitate the environmentally destructive kimberlite tailings at the mine by providing economic incentive for the remediation of the scarred landscape. At the same time an environmentally sustainable brick of superior quality and characteristics can be produced and supplied to the building industry. (Angel Investment Network: 2014)

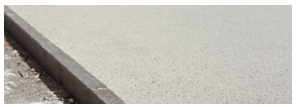
In the context of the proposed project following the decommissioning of the mine, this kimberlite brick-making plant in Cullinan is assumed to already exist. The clay bricks shown in **figure 7.18**, made by this plant will be utilized during the construction process of the proposed project.

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WEATHERED CONCRETE FLOORSLABS


USED AS RECLAIMED CONCRETE PAVERS


WASTE ROCK


USED AS AGGREGATE IN NEW CONCRETE FLOORSLABS AND WALLS


WASTE ROCK

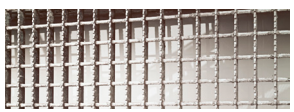

USED IN GABION WALLS


KIMBERLITE TAILINGS


USED TO MANUFACTURE KIMBERLITE ENRICHED CLAY BRICKS

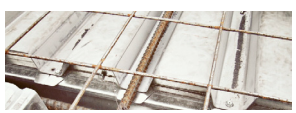

MILD STEEL BEAMS AND COLUMNS


SALVAGED AND RECLAIMED TO BE USED AS STRUCTURAL BEAMS AND COLUMNS


MILD STEEL MENTIS GRATING


RECLAIMED TO BE USED AS FLOOR PANELS IN GREENHOUSES AND ESSENTIAL OIL EXTRACTION FACILITY


GALVANIZED IBR-PROFILE STEEL SHEETING


RE-USED AS PERMANENT SHUTTER OF COMPOSITE SHORT SPAN FLOORS

7.19 _ Materials with potential to be salvaged, reclaimed and re-used at the Cullinan mine (Author: 2014, Labuschagne: 2013, edited by author).

SALVAGED, RECLAIMED AND RE-USED MATERIALS/

Currently, a variety of materials on site at the mine offer significant opportunity and potential to be salvaged, reclaimed and re-used. This drastically lowers the embodied energy of the construction materials in two ways, namely: much less energy is required for the manufacture of materials when these raw materials can be sourced, recycled and manufactured on site. Considerably less energy is expended as no transportation is required for the manufactured materials already located on the site.

WEATHERED CONCRETE FLOOR SLABS:

Existing concrete floor slabs that are weathered, cracked and broken will be crushed and broken up to a suitable size to be re-used as concrete pavers along the public promenade.

WASTE ROCK:

The waste-rock dumping site where the proposed intervention is located will be used to provide thermal mass for the submerged production spaces. This waste rock will also be sorted according to size and used as aggregate in new concrete floors and retaining walls to be cast on site as well as being used for the construction of gabion retaining walls.

KIMBERLITE TAILINGS:

Vast kimberlite tailings are located within and around the mining compounds. As discussed previously, these tailings will be utilized to manufacture high-quality clay bricks to be used in the construction of masonry load-bearing, non-load-bearing and retaining walls.

HOT-ROLLED MILD STEEL BEAMS AND COLUMNS:

A significant number of hot-rolled mild steel structural beams and columns can currently be found at the mine scrap yard. These structural members, along with steel beams and columns reclaimed during the disassembly of the mining structures and warehouses, will be cleaned and re-used for the structural framework of the proposed intervention.

MILD STEEL MENTIS GRATING:

A large quantity of mild steel mentis grating is currently used for various applications at the mine, such as grilles, screens and floors. These mentis grating panels will be cleaned and re-used as floor material in the proposed hydroponic greenhouse located within the existing crusher building.

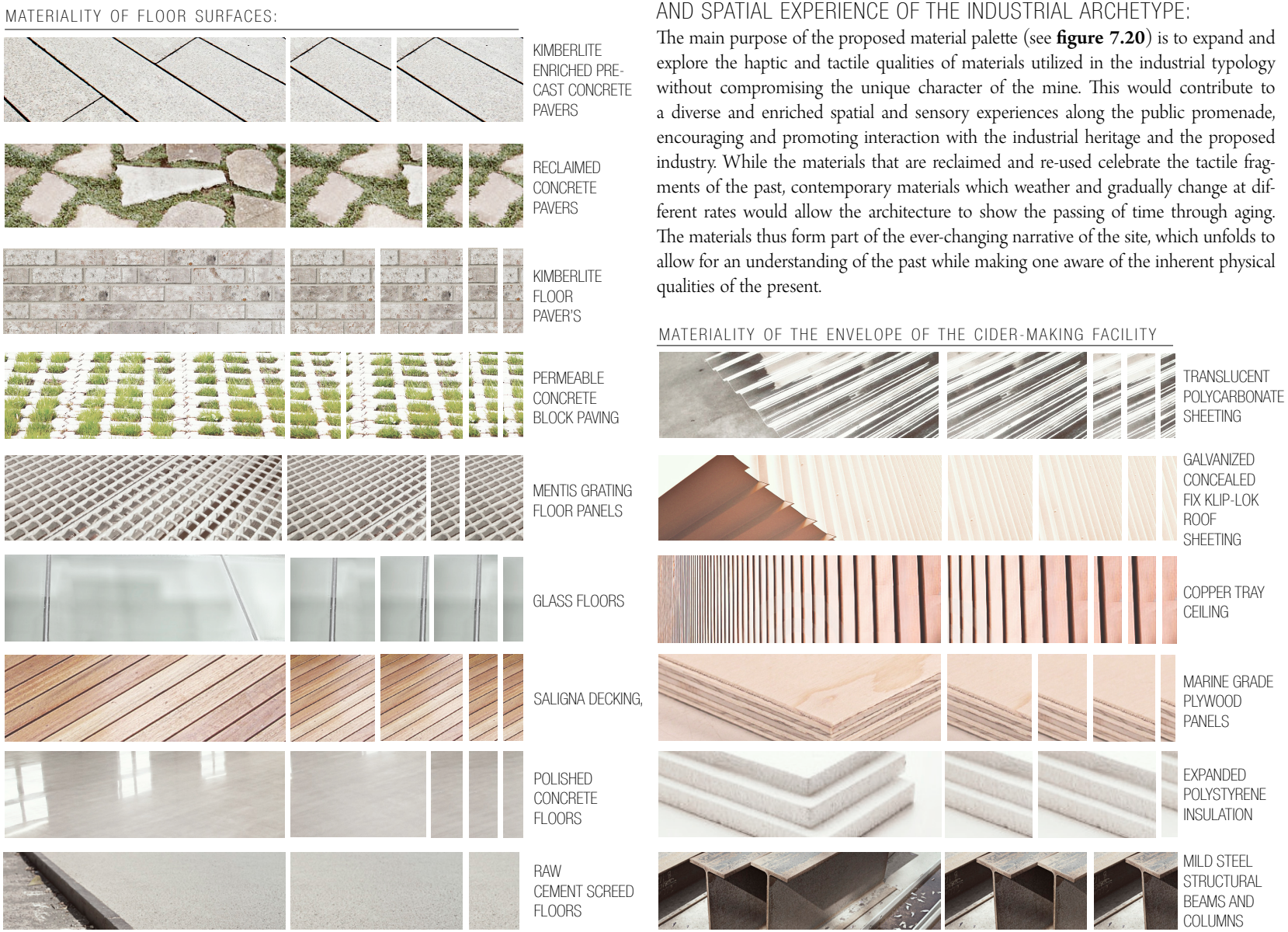
GALVANIZED MILD STEEL IBR-PROFILE SHEETING:

Most of the newer warehouses and buildings are clad with galvanized steel IBR-profile sheeting, which is mostly still in a very good condition. This sheeting will be removed and reclaimed from existing buildings such as the crusher building, where it will be replaced with polycarbonate sheeting to enable the adaptive re-use of the internal spaces as a hydroponic greenhouse. The reclaimed sheeting will be re-used as permanent shuttering for new short-span composite floor slabs.

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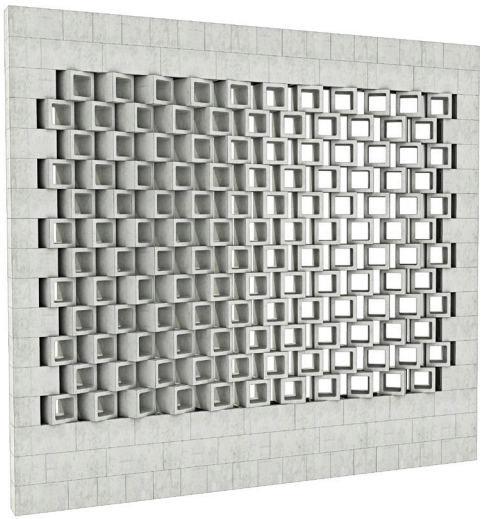
PROPOSED MATERIAL PALETTE/ EXPANDING AND REINTERPRETING THE EXISTING MATERIALITY TO REDEFINE THE VISITOR'S SENSORY AND SPATIAL EXPERIENCE OF THE INDUSTRIAL ARCHETYPE:

The main purpose of the proposed material palette (see **figure 7.20**) is to expand and explore the haptic and tactile qualities of materials utilized in the industrial typology without compromising the unique character of the mine. This would contribute to a diverse and enriched spatial and sensory experiences along the public promenade, encouraging and promoting interaction with the industrial heritage and the proposed industry. While the materials that are reclaimed and re-used celebrate the tactile fragments of the past, contemporary materials which weather and gradually change at different rates would allow the architecture to show the passing of time through aging. The materials thus form part of the ever-changing narrative of the site, which unfolds to allow for an understanding of the past while making one aware of the inherent physical qualities of the present.



7.20 _ The proposed material palette, expanding and reinterpreting the existing materiality to redefine the visitors sensory and spatial experience of the industrial archetype (Author: 2014).

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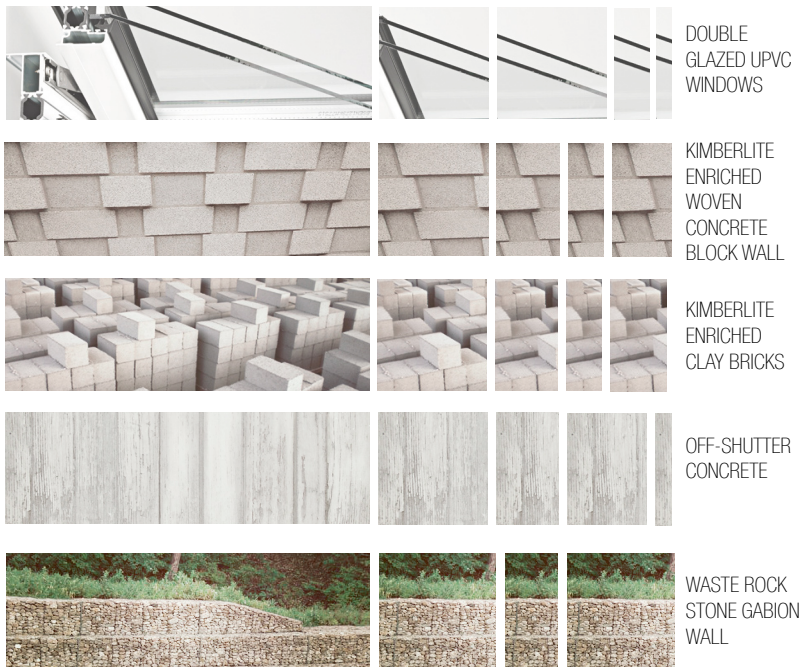


7.21 _ Kimberlite enriched woven concrete block wall at the cider-making facility (Author: 2014).

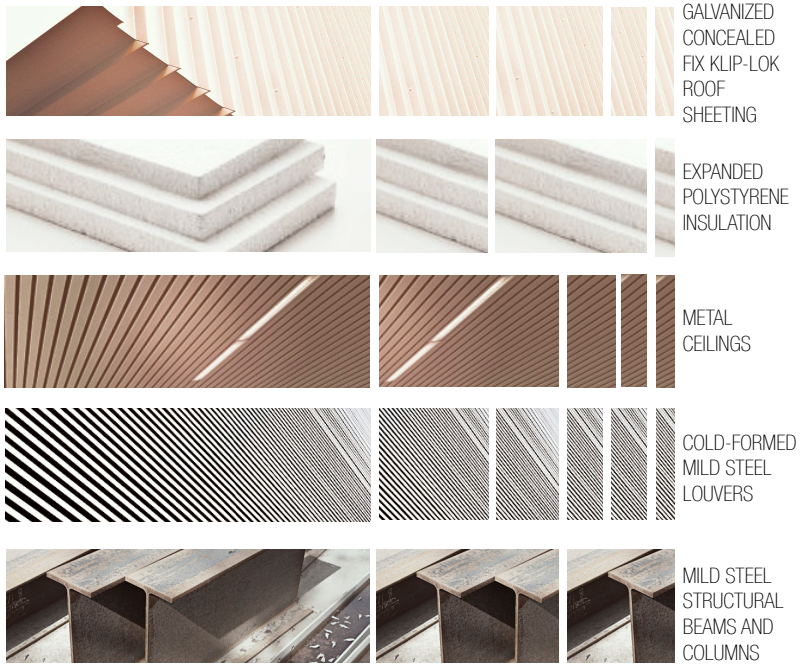
PROPOSED MATERIAL PALETTE/ EXPANDING AND REINTERPRETING THE EXISTING MATERIALITY TO REDEFINE THE VISITOR'S SENSORY AND SPATIAL EXPERIENCE OF THE INDUSTRIAL ARCHETYPE:

The essential oil extraction facility draws from the materiality of the existing industry and redefines it to respond to the experiential and spatial requirements of the new industry, while the cider-making facility reconciles industry with the landscape through its use of materials.

MATERIALITY OF WALLS AND GLAZING:

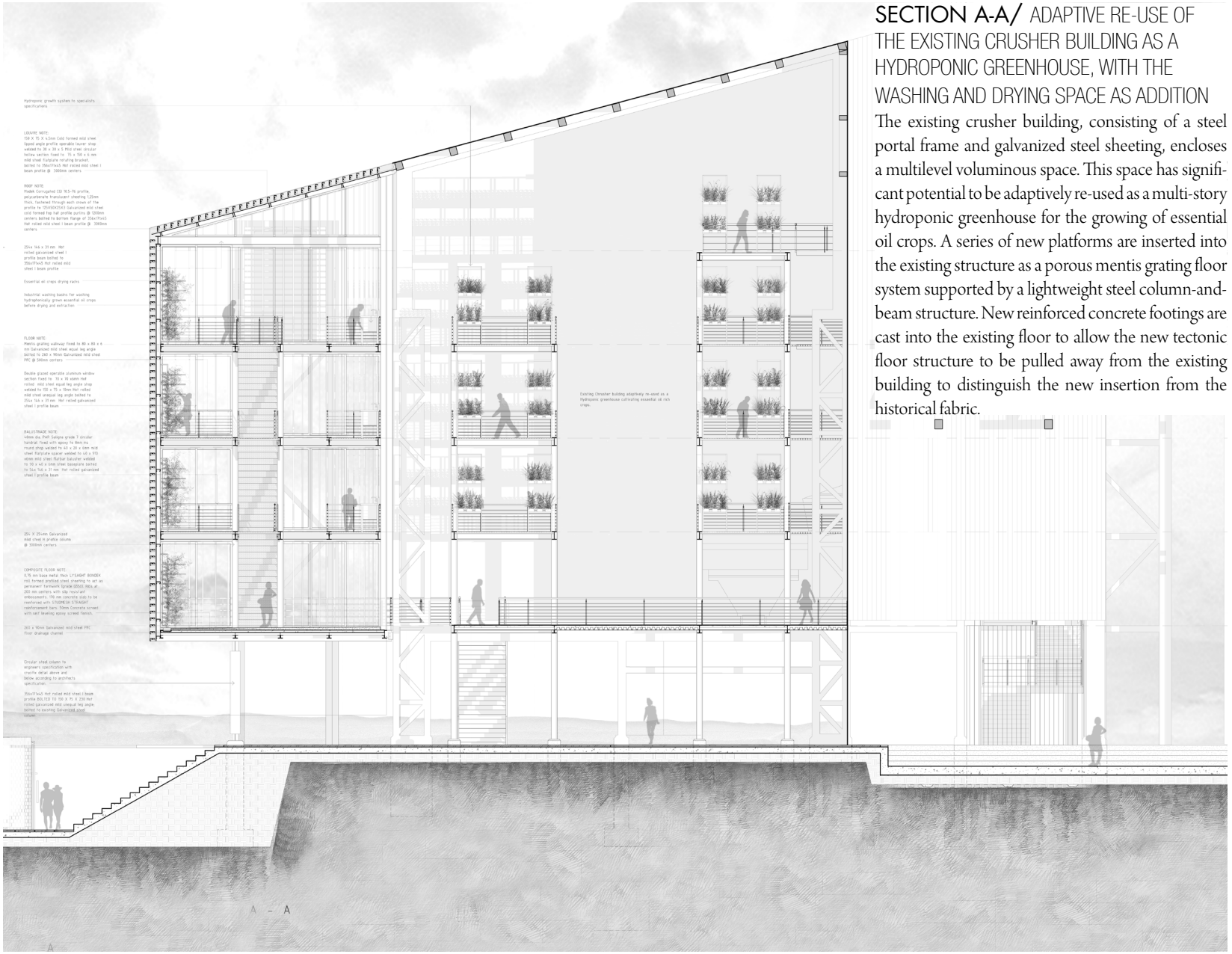


MATERIALITY OF THE ENVELOPE OF THE ESSENTIAL OIL EXTRACTION FACILITY:



7.22 _ The proposed material palette, expanding and reinterpreting the existing materiality (Author: 2014).

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SECTION A-A/ ADAPTIVE RE-USE OF THE EXISTING CRUSHER BUILDING AS A HYDROPONIC GREENHOUSE, WITH THE WASHING AND DRYING SPACE AS ADDITION

The existing crusher building, consisting of a steel portal frame and galvanized steel sheeting, encloses a multilevel voluminous space. This space has significant potential to be adaptively re-used as a multi-story hydroponic greenhouse for the growing of essential oil crops. A series of new platforms are inserted into the existing structure as a porous mentis grating floor system supported by a lightweight steel column-and-beam structure. New reinforced concrete footings are cast into the existing floor to allow the new tectonic floor structure to be pulled away from the existing building to distinguish the new insertion from the historical fabric.

7.23 _ Section A-A The existing crusher building adaptively reused as a Hydrophonic greenhouse with the washing and drying space as a tectonic addition (Author: 2014).

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ESSENTIAL OIL CROPS GROWN IN THE SCARRED LANDSCAPE AND SURROUNDING AREA:



VETIVER
CHRYSOPOGON ZIZANIOIDES



USES:
PERFUMERY
FLAVOURING
THERAPEUTIC



ALOE VERA
ALOE BARBADENSIS



USES:
MEDICINAL
THERAPEUTIC



EUCALYPTUS
EUCALYPTUS TERETICORNIS



USES:
MEDICINAL
THERAPEUTIC

ESSENTIAL OIL CROPS GROWN HYDROPONICALLY:



ROSEMARY
ROSMARINUS OFFICINALIS



USES:
THERAPEUTIC
FLAVOURING



CITRONELLA
CYMBOPOGON WINTERIANUS



USES:
MEDICINALLY
INSECT REPELLENT



GERANIUM
GERANIUM DISSECTUM



USES:
MEDICINALLY
THERAPEUTIC



WORMWOOD
ARTEMISIA CINA



USES:
MEDICINALLY
PERFUMERY
FLAVOURING



LEMON GRASS
CYMBOPOGON



USES:
THERAPEUTIC
PERFUMERY



LAVENDIN
LAVANDULA INTERMEDI



USES:
THERAPEUTIC
PERFUMERY



LIPPIA
LIPPIA ALBA



LIPPIA
MEDICINAL
FLAVOURING

7.24 _ Showing the proposed essential oil crops to be grown at the mine (Author: 2014).

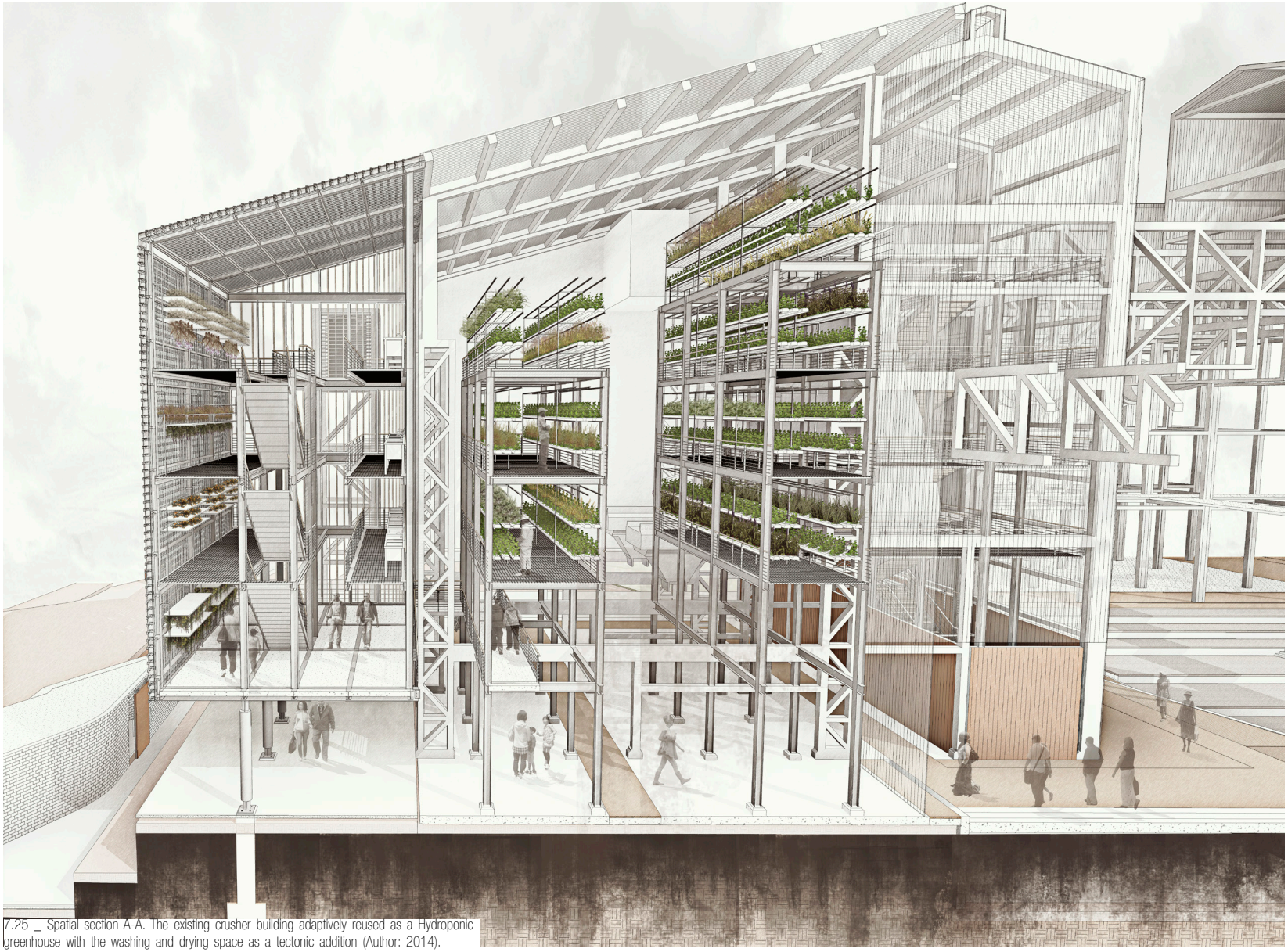
PROPOSED ESSENTIAL OIL CROPS/

TO BE GROWN HYDROPONICALLY WITHIN THE GREENHOUSE STRUCTURE, IN THE REMEDIATED SCARRED LANDSCAPE AND IN THE SURROUNDING AREA BY LOCAL FARMERS

Various species of essential oil crops will be propagated at the Cullinan mine as shown in **Figure 7.24**. These essential oil plants will be either cultivated within the scarred landscape to aid in its remediation as is the case with Vetiver grass, Aloe vera and Eucalyptus, which are all species that are also used for remediation and stabilization of ground condition. Furthermore the essential oil extraction facility will provide local farmers in Cullinan with an opportunity to diversify their current agricultural practices to include essential oil crops which are a very profitable when considering their value in relation to the area of land they occupy. Mairapetyan (1999) states that: "Experiments have shown that hydroponically grown aromatic plants have higher productivity, in addition to accumulate 3-6 times more essential oil per unit of feeding surface, compared with field grown ones. The root environment of hydroponic plants is abundantly provided with water, nutrients and air, with a corresponding increase of the metabolic and absorbing activity of roots, which, in its turn, initiates development of plant overground part with increasing biological and economical productivity several folds." Substantiated by this research it is proposed that various other essential oil crops such as Rosemary, Citronella, Geranium, Wormwood, Lemon grass, Lavendin and Lippia be grown hydroponically within the structure inserted into the existing Crusher building.

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SPATIAL SECTION A-A/HYDROPONIC GREENHOUSE STRUCTURE, WASHING AND DRYING SPACE

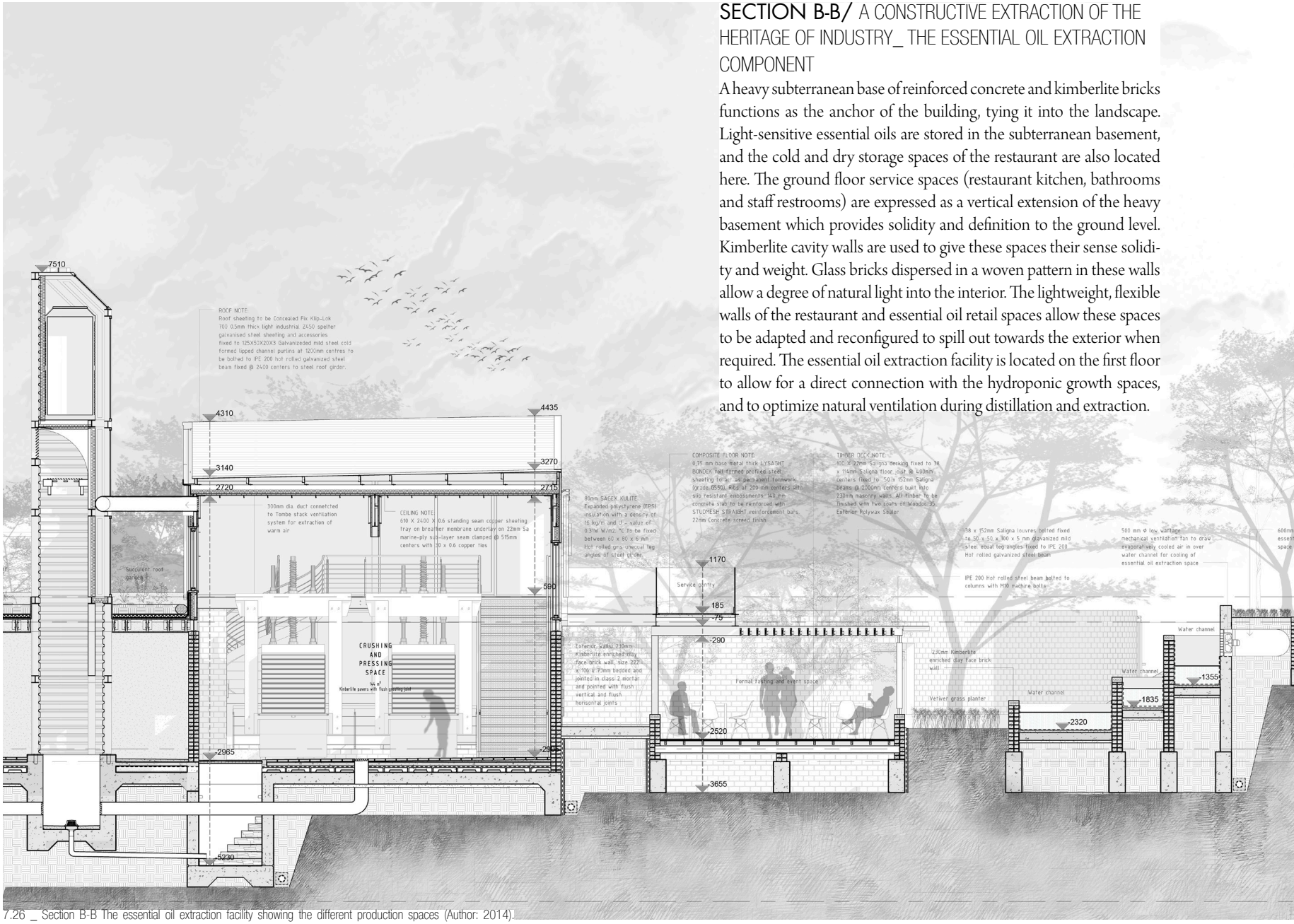


7.25 _ Spatial section A-A. The existing crusher building adaptively reused as a Hydroponic greenhouse with the washing and drying space as a tectonic addition (Author: 2014).

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SECTION B-B/ A CONSTRUCTIVE EXTRACTION OF THE HERITAGE OF INDUSTRY_ THE ESSENTIAL OIL EXTRACTION COMPONENT

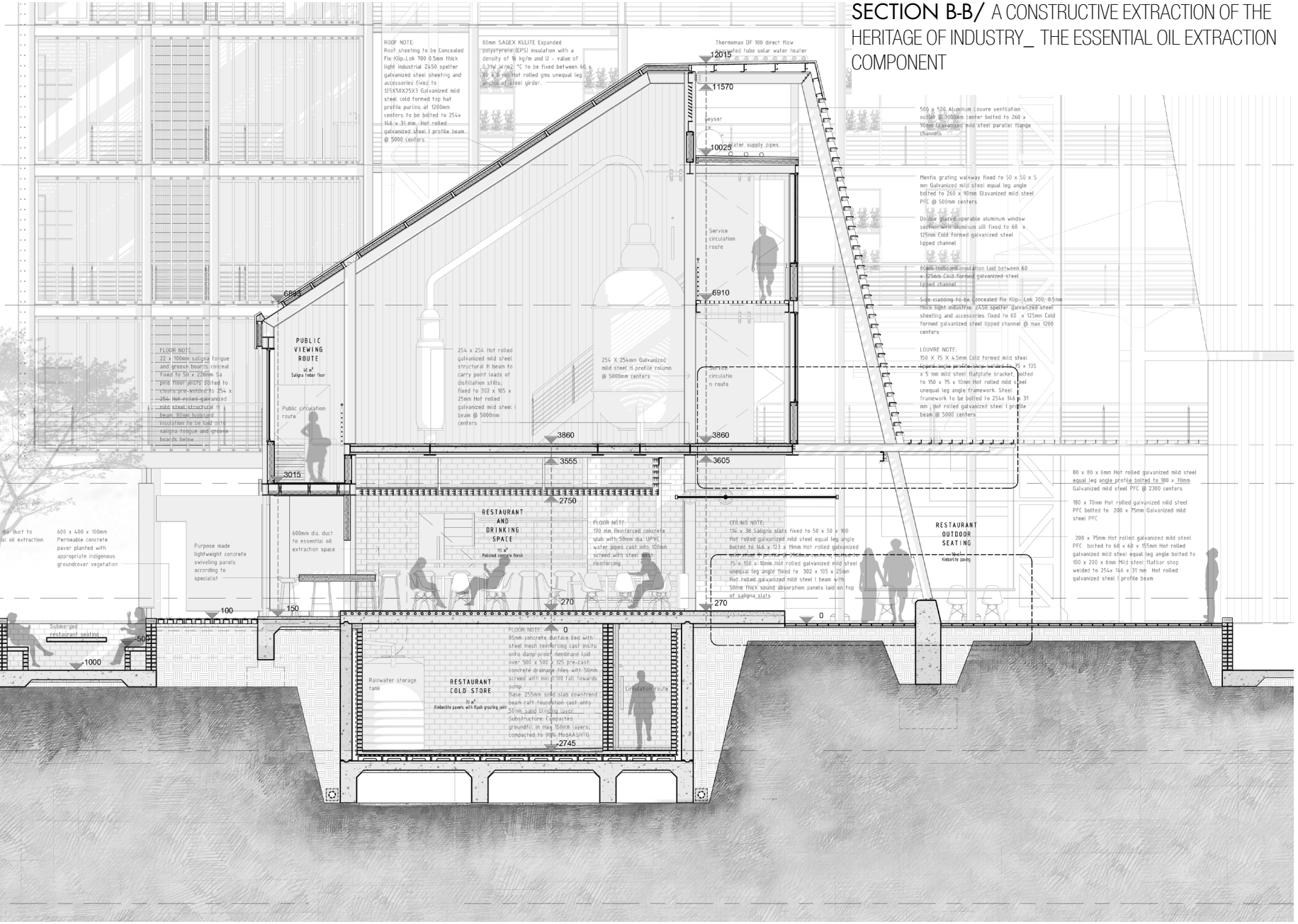
A heavy subterranean base of reinforced concrete and kimberlite bricks functions as the anchor of the building, tying it into the landscape. Light-sensitive essential oils are stored in the subterranean basement, and the cold and dry storage spaces of the restaurant are also located here. The ground floor service spaces (restaurant kitchen, bathrooms and staff restrooms) are expressed as a vertical extension of the heavy basement which provides solidity and definition to the ground level. Kimberlite cavity walls are used to give these spaces their sense solidity and weight. Glass bricks dispersed in a woven pattern in these walls allow a degree of natural light into the interior. The lightweight, flexible walls of the restaurant and essential oil retail spaces allow these spaces to be adapted and reconfigured to spill out towards the exterior when required. The essential oil extraction facility is located on the first floor to allow for a direct connection with the hydroponic growth spaces, and to optimize natural ventilation during distillation and extraction.



7.26 _ Section B-B The essential oil extraction facility showing the different production spaces (Author: 2014).

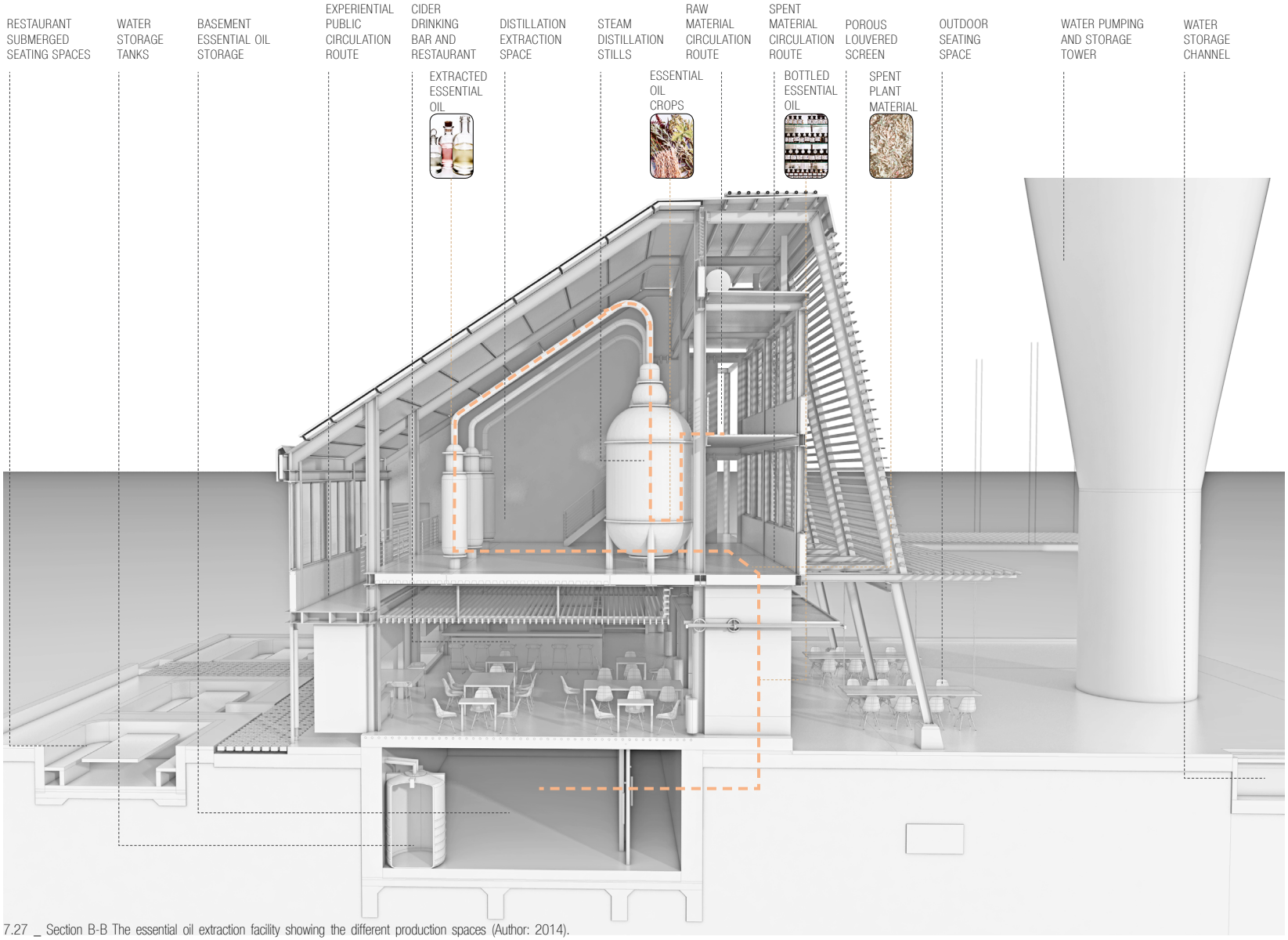
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SECTION B-B/ A CONSTRUCTIVE EXTRACTION OF THE HERITAGE OF INDUSTRY_ THE ESSENTIAL OIL EXTRACTION COMPONENT



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SPATIAL SECTION B-B/ A CONSTRUCTIVE EXTRACTION OF THE HERITAGE OF INDUSTRY_ THE ESSENTIAL OIL EXTRACTION COMPONENT SHOWING THE RELATIONSHIP BETWEEN SPACES, THE PRODUCTION PROCESSES AND THE FLOW OF MATERIAL

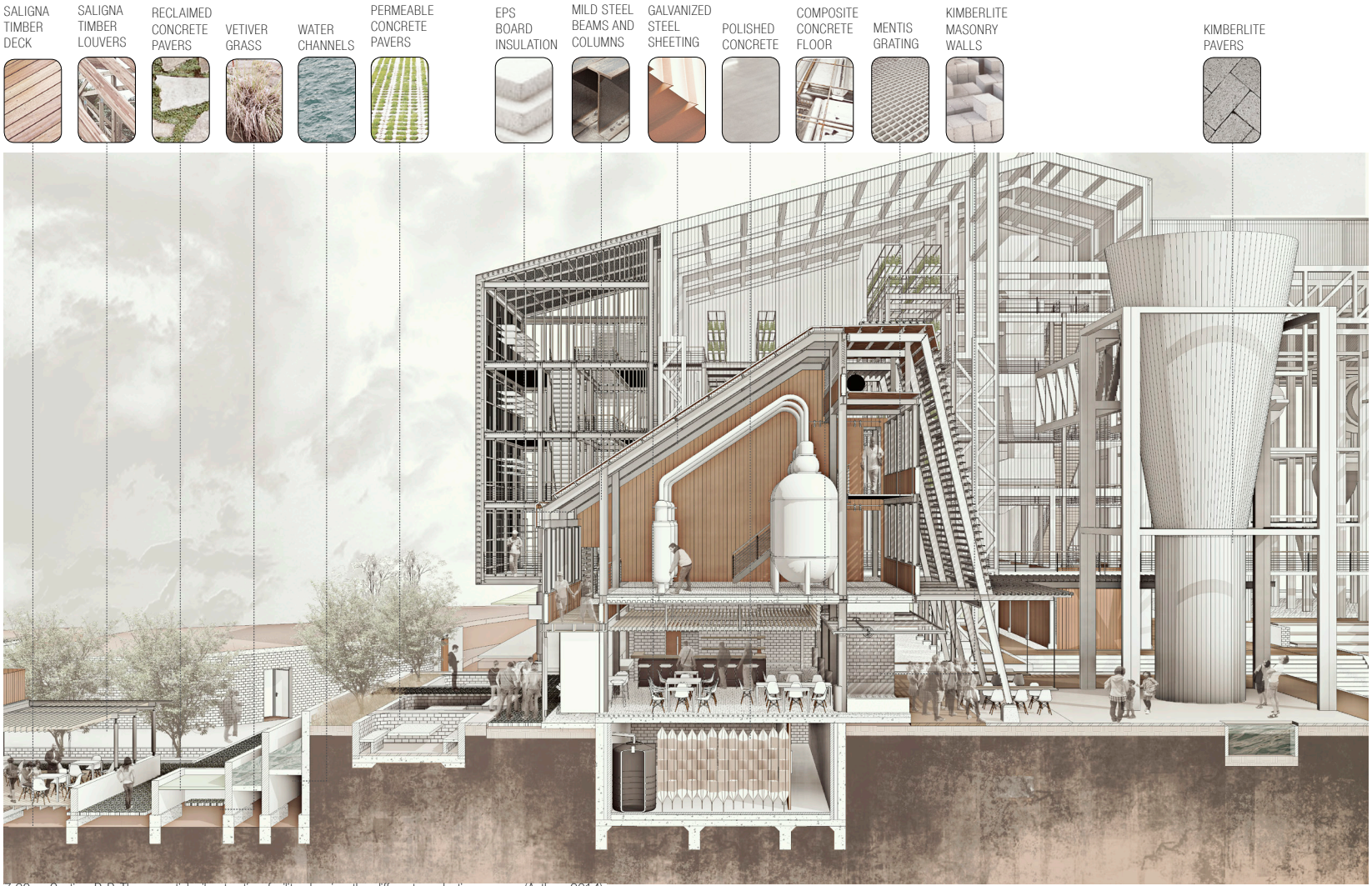


7.27 _ Section B-B The essential oil extraction facility showing the different production spaces (Author: 2014).

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SPATIAL SECTION B-B/ A CONSTRUCTIVE EXTRACTION OF THE HERITAGE OF INDUSTRY_ THE ESSENTIAL OIL EXTRACTION COMPONENT SHOWING PRODUCTION PROCESSES

The technical resolution of the essential oil extraction facility is in dialogue with the existing industrial heritage by drawing from the typology, materiality and detailing of the surrounding industrial context.

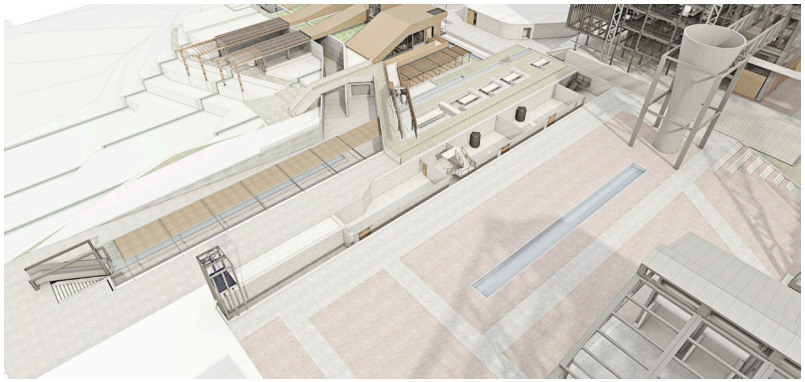


7.28 _ Section B-B The essential oil extraction facility showing the different production spaces (Author: 2014).

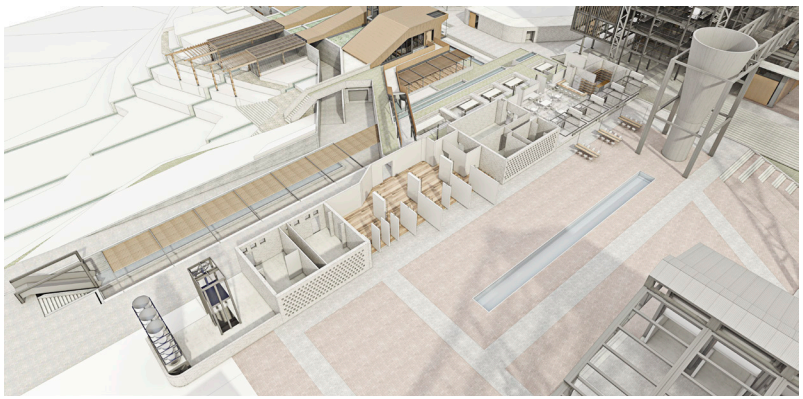
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CONSTRUCTION SEQUENCE / ESSENTIAL OIL EXTRACTION FACILITY

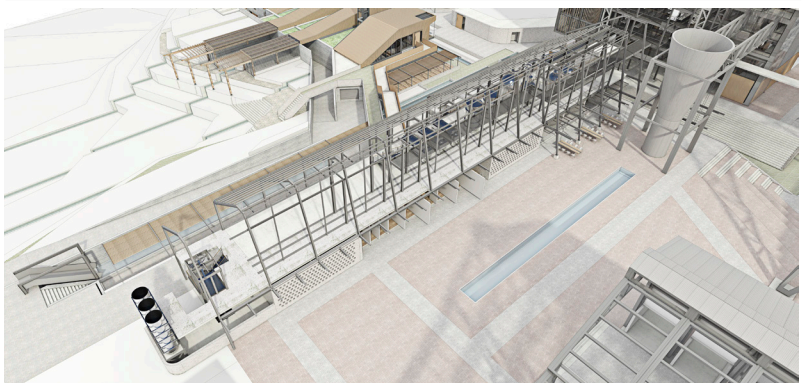
01_BASEMENT AND EXCAVATIONS



02_LOADBEARING WALLS, PARTITIONS AND PRIMARY STRUCTURE



03_PRIMARY STEEL STRUCTURE AND PURLINS:

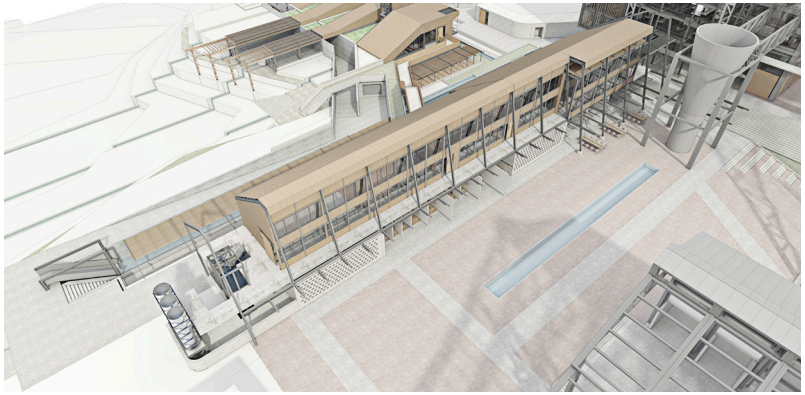


7.29 _ Construction sequence Essential oil extraction facility (Author: 2014).

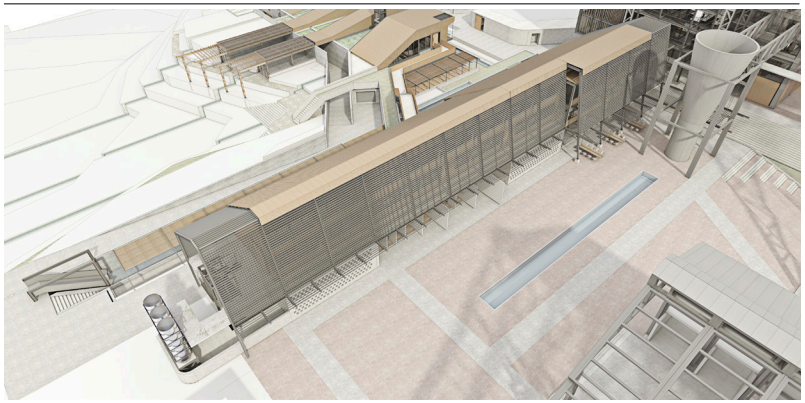
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CONSTRUCTION SEQUENCE / ESSENTIAL OIL EXTRACTION FACILITY

04_EXTERIOR CLADDING, INFILL PANELS AND FENESTRATION:



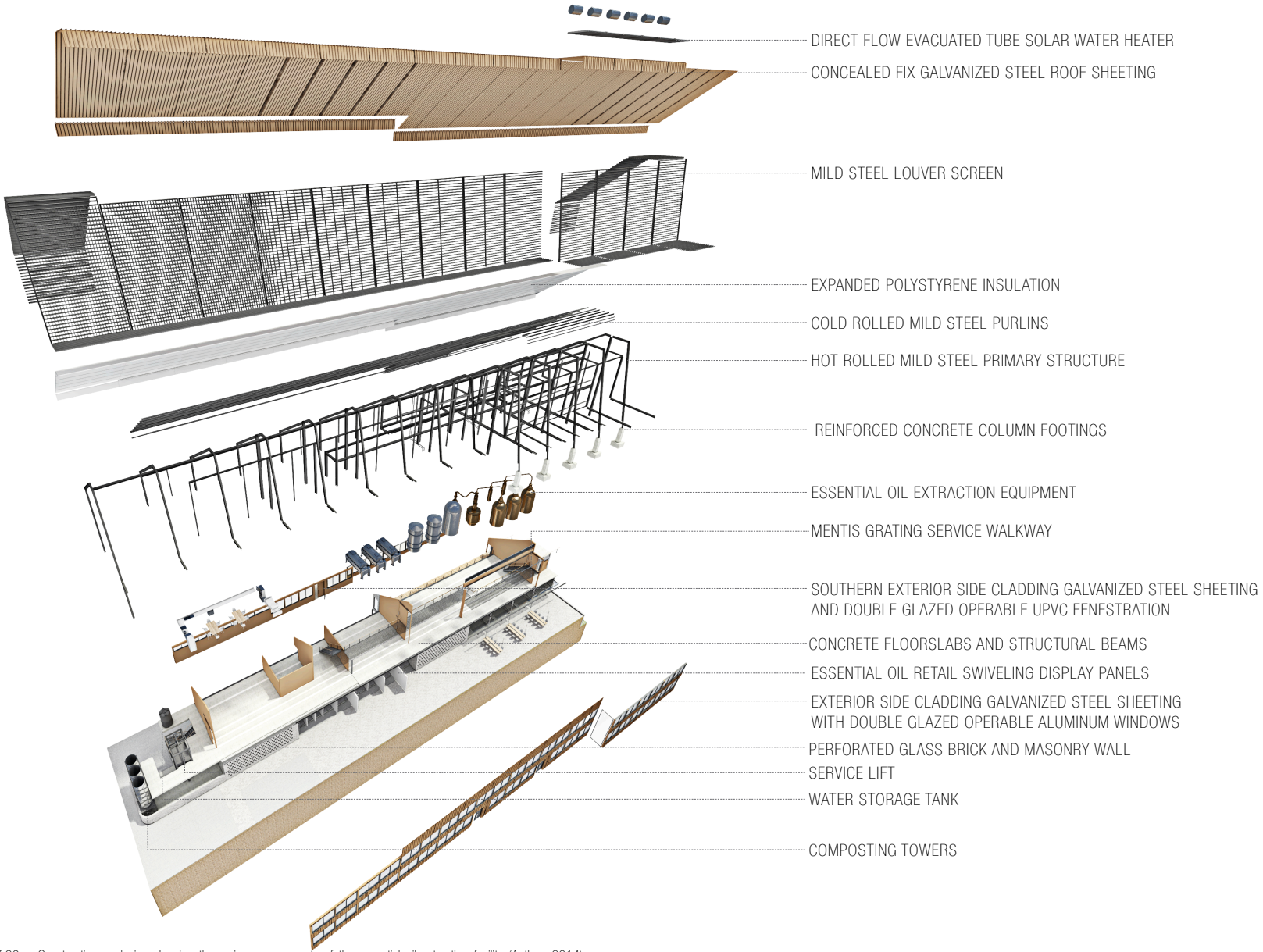
05_PERFORATED STEEL SCREEN AS ENVIRONMENTAL CONTROL DEVICE AND PRIVACY SCREEN



7.29 _ Construction sequence Essential oil extraction facility (Author: 2014).

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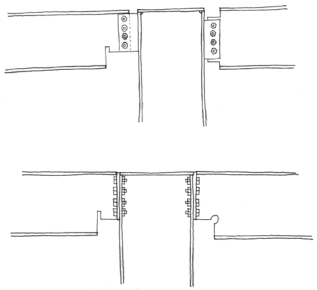
EXPLODED SECTION/
ESSENTIAL OIL EXTRACTION FACILITY COMPONENTS



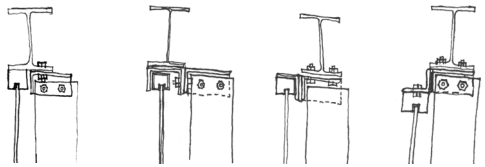
7.30 _ Construction explosion showing the various components of the essential oil extraction facility (Author: 2014).

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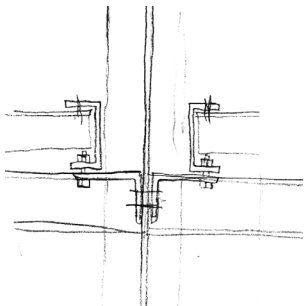
DETAIL DEVELOPMENT/ EXPLORING THE TECTONIC CONCEPT OF CONSTRUCTIVE EXTRACTION



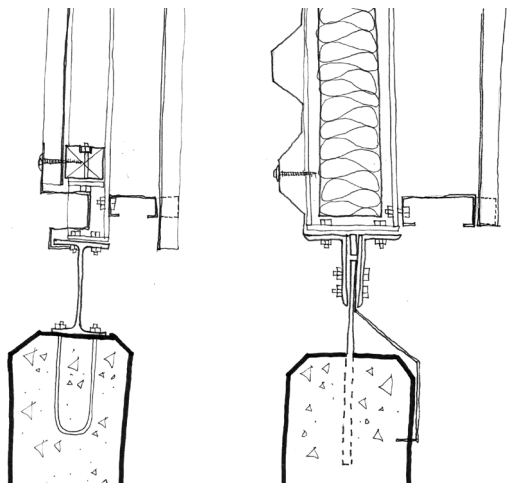
7.31 _ Exploring the idea of extraction by means of pulling away the structural beams from the supporting columns (Author: 2014).



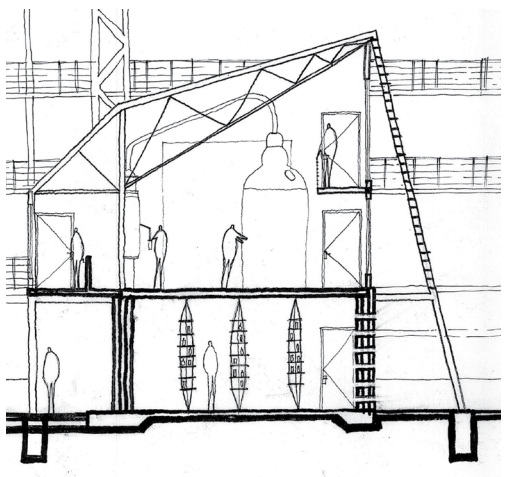
7.33 _ Investigating different ways of pulling the glazing away from the timber louvers in the greenhouse (Author: 2014).



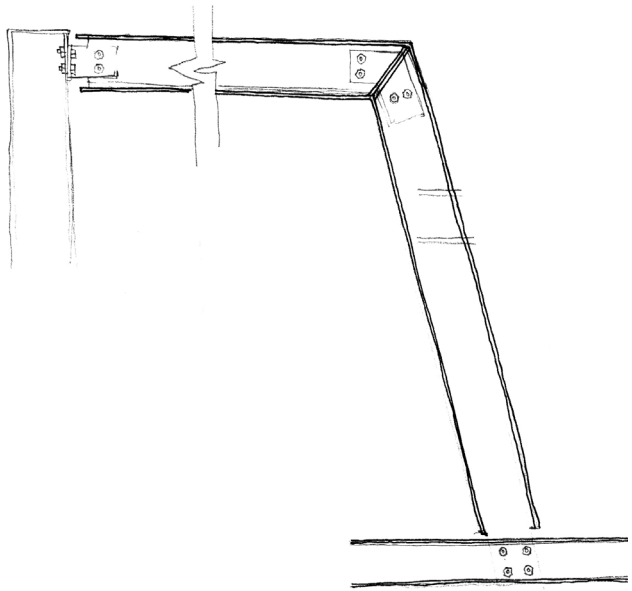
7.34 _ Conceptual development of the connection between the pergola beams and the structural column (Author: 2014).



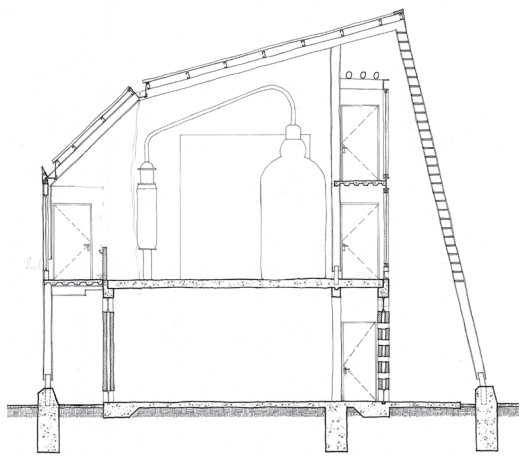
7.32 _ Conceptual development of the connection between stereotomic and tectonic to give expression to the concept of extraction (Author: 2014).



7.35 _ Development of the roof truss structure in the essential oil extraction facility (Author: 2014).



7.36 _ Exploring different connection methods between the roof beam and structural columns (Author: 2014).



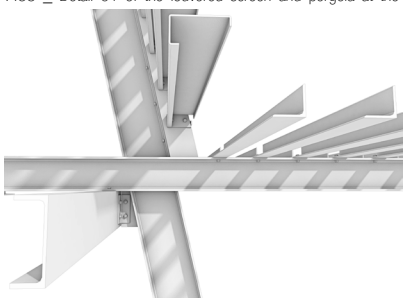
7.37 _ Development of the roof truss structure and envelope of the essential oil extraction facility (Author: 2014).

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01_MATERIALITY



7.38 _ Detail 01 of the louvered screen and pergola at the essential oil extraction facility showing the materiality (Author: 2014).



7.39 _ Showing the exposed bolted connection between the column and the channel which supports the beams of the pergola (Author: 2014).

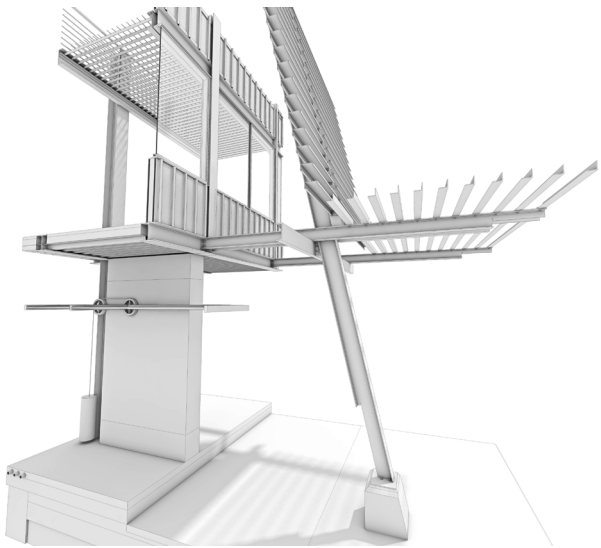


7.40 _ Showing how the louvers are bolted to an unequal leg angle to create a separation. (Author: 2014).

DETAIL 01/ LOUVERED SCREEN AND PERGOLA

The louvered screen and pergola of the essential oil extraction facility are detailed to express the intentions of the tectonic concept of extraction as shown in **Figure 7.38.** This is achieved by retaining the individual identity of the components which make up the composite envelope. The beams of the pergola are therefore not directly fixed to the column of the louvered screen, but rather slide past it and rest on a channel that is fixed behind the column. This threshold between the two elements is detailed as an exposed bolted connection, shown in **Figure 7.39**, referencing the detailing of the No. 1 Shaft. The louvers are also not directly attached to the structural column, but are bolted to an unequal leg angle which creates separation, as shown in **Figure 7.40.** This allows the column to read as a continuous entity which extends toward the sky to support the roof. Furthermore, where the tectonic structural column meets the stereotomic footing, it is pulled away by resecting its flange in order to emphasize it being an entity in its own right. The connections between the various parts such as the louvers, the structural beams, and the columns and footings are detailed as expressive bolted, rather than welded, connections. This allows each entity to be individually distinguishable from the collective that makes up the whole.

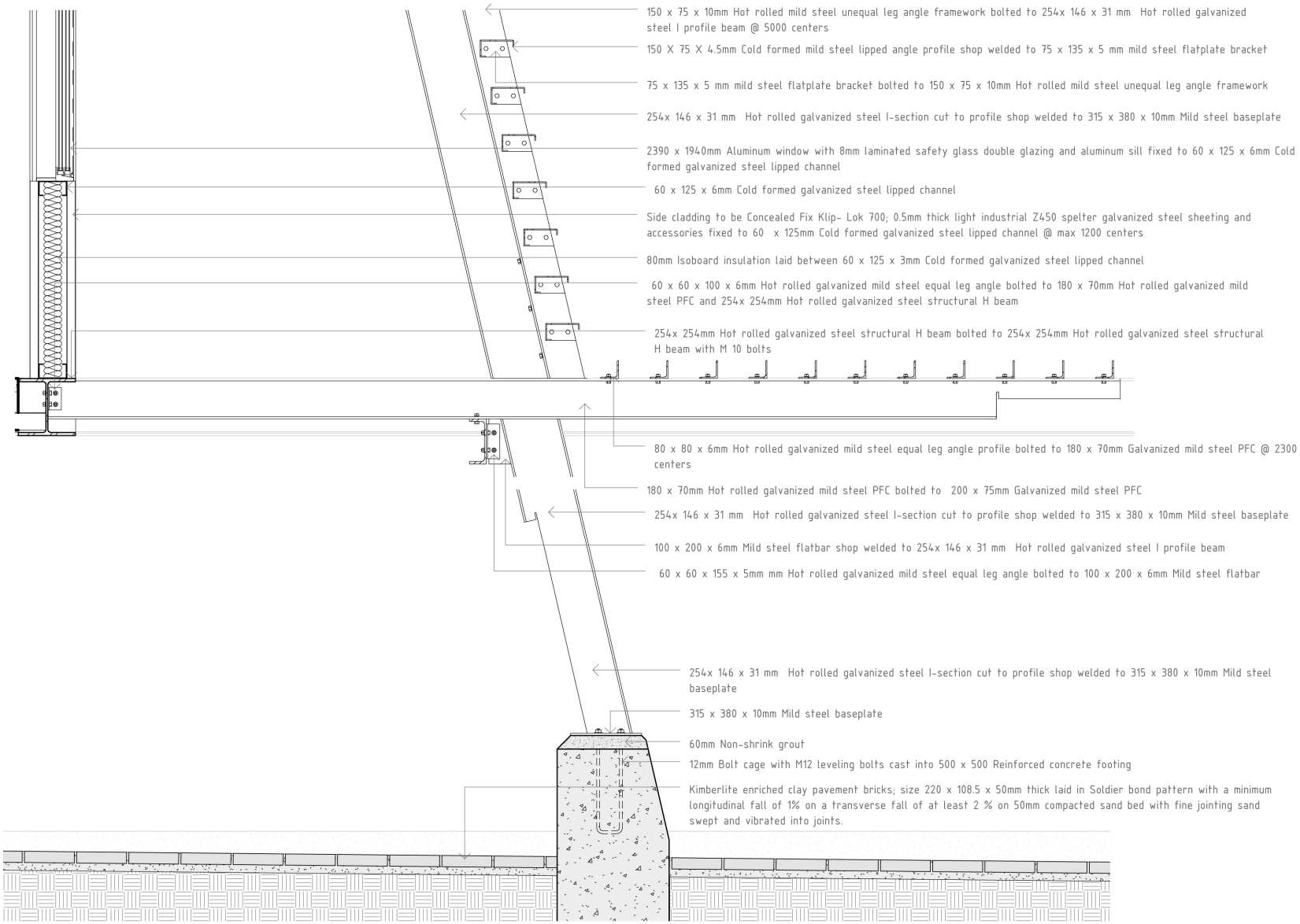
02_CONNECTIONS



7.41 _ Showing how the conceptual approach of extraction was employed in the connections between the components which make up the whole (Author: 2014).

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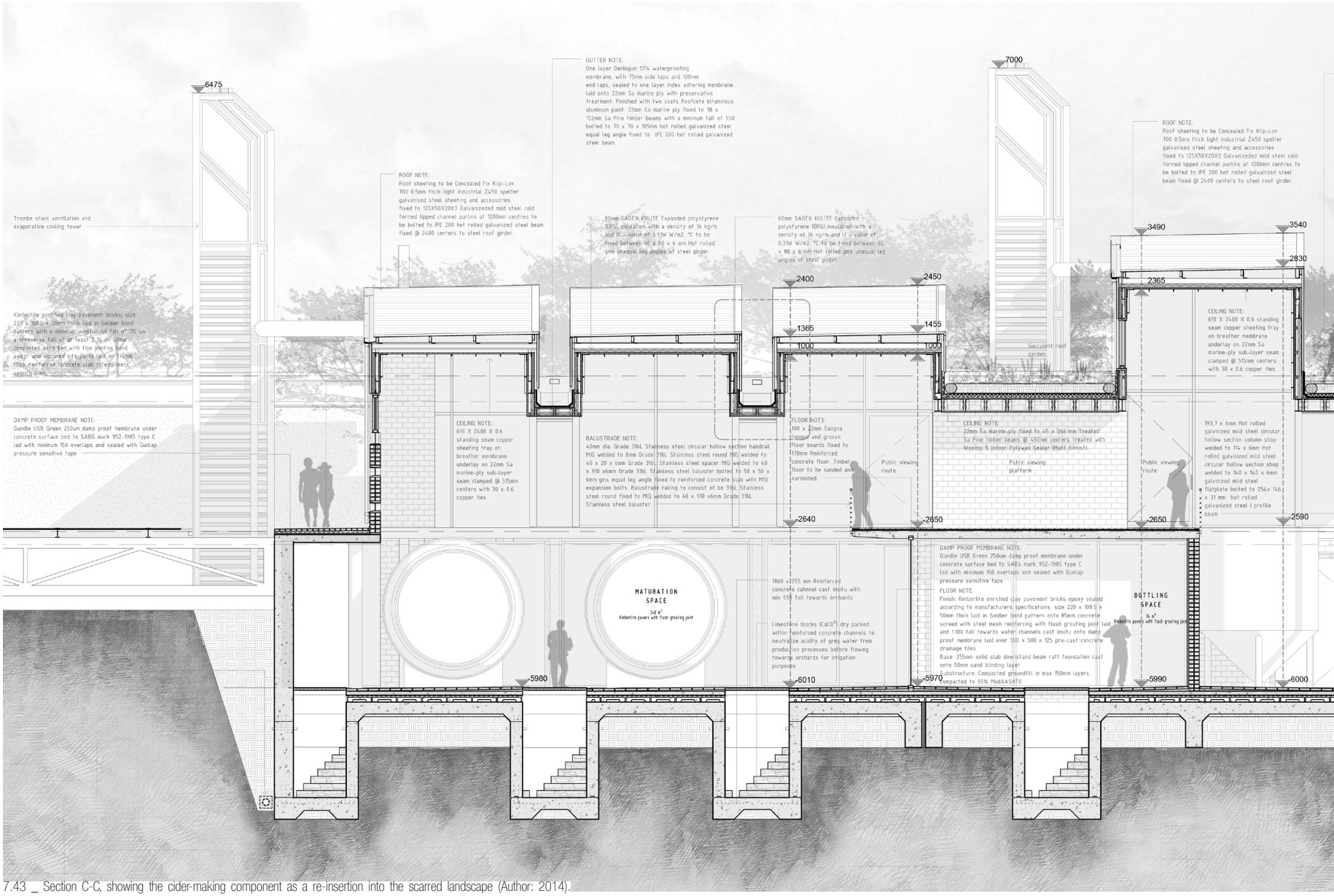
DETAIL 01/ LOUVERED SCREEN AND PERGOLA



7.42_ Detail 01 of the louvered screen and pergola at the essential oil extraction facility showing specifications (Author: 2014).

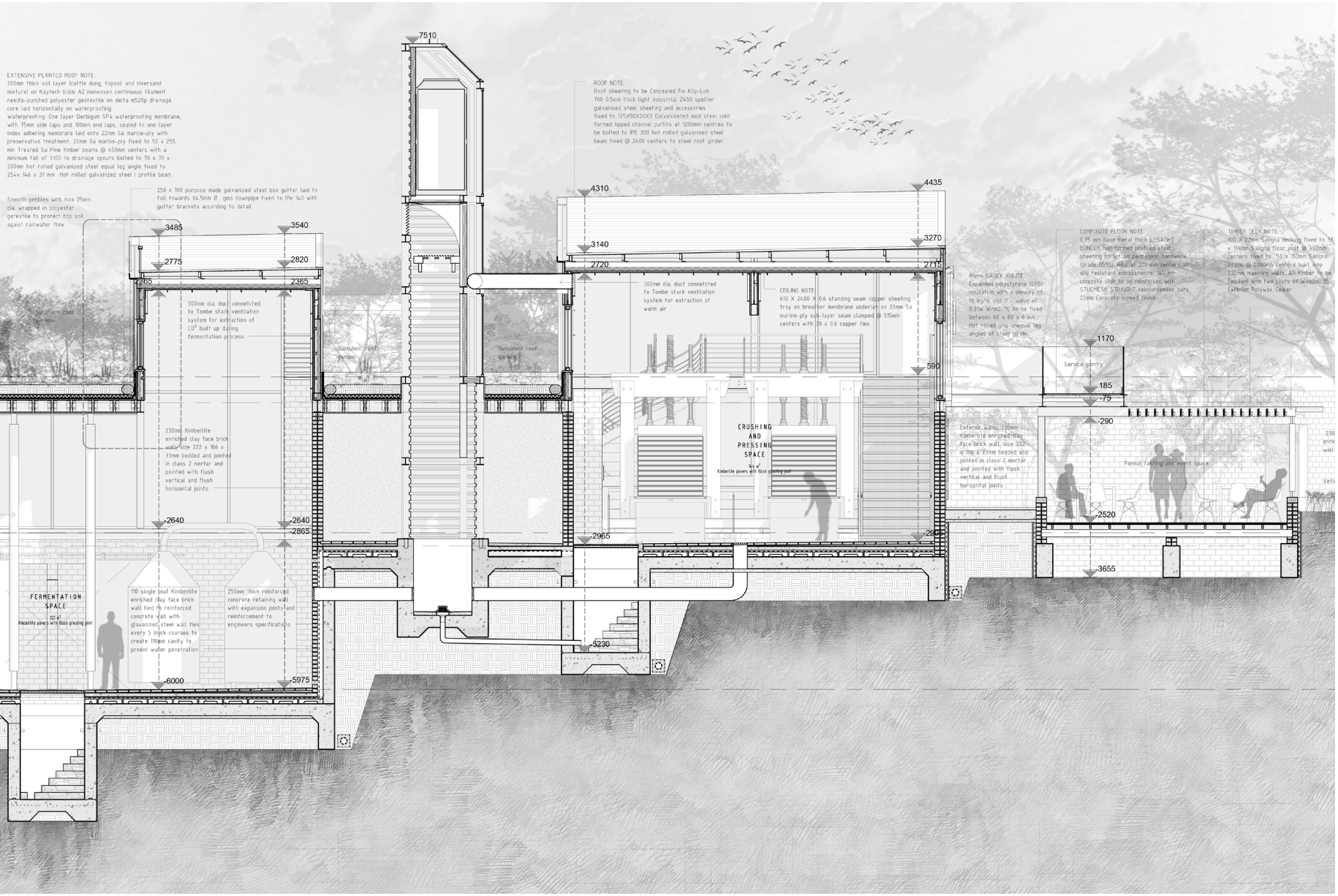
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SECTION C-C/A REINSERTION INTO THE SCARRED LANDSCAPE _ THE CIDER-MAKING COMPONENT



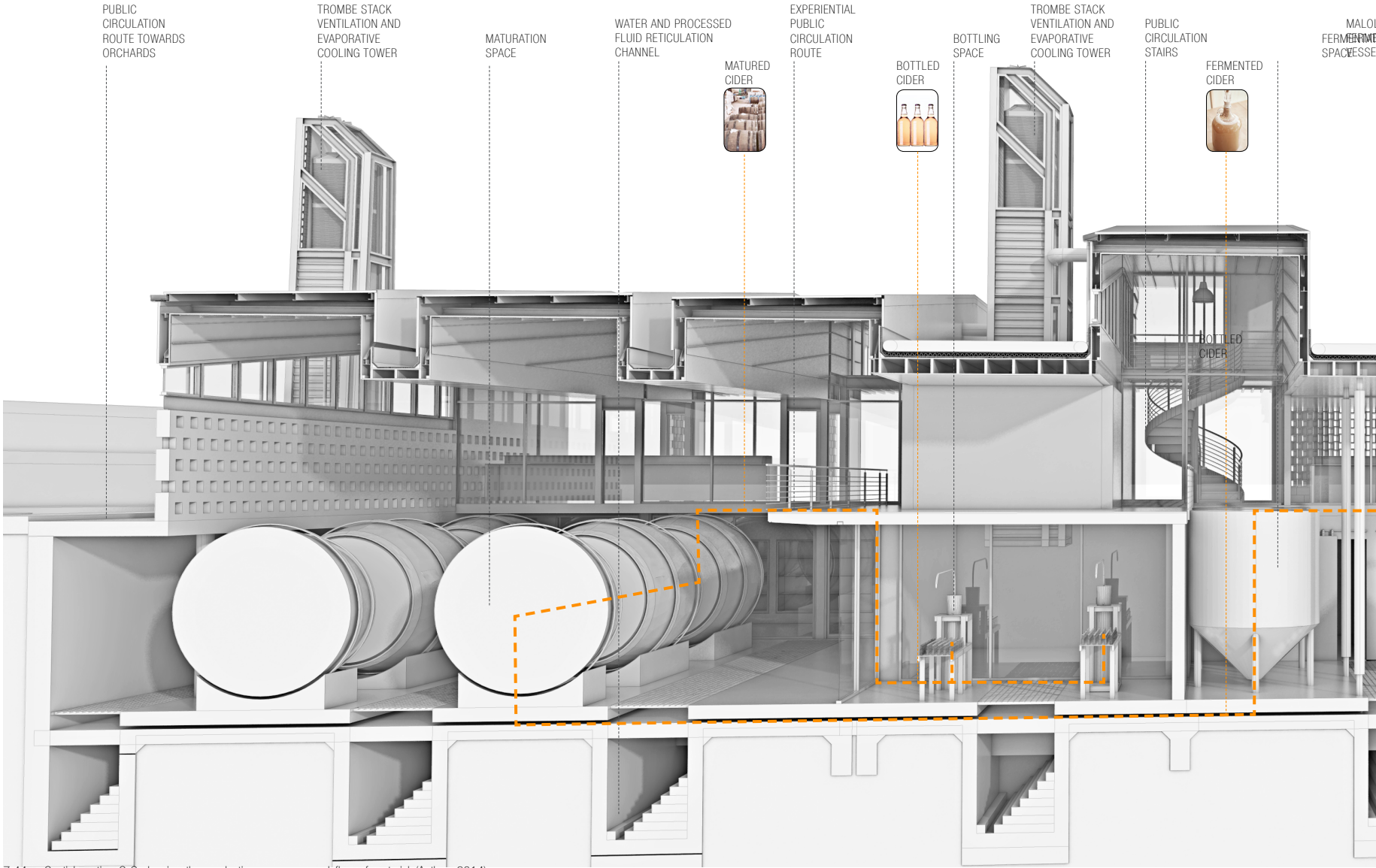
7.43 _ Section C-C, showing the cider-making component as a re-insertion into the scarred landscape (Author: 2014).

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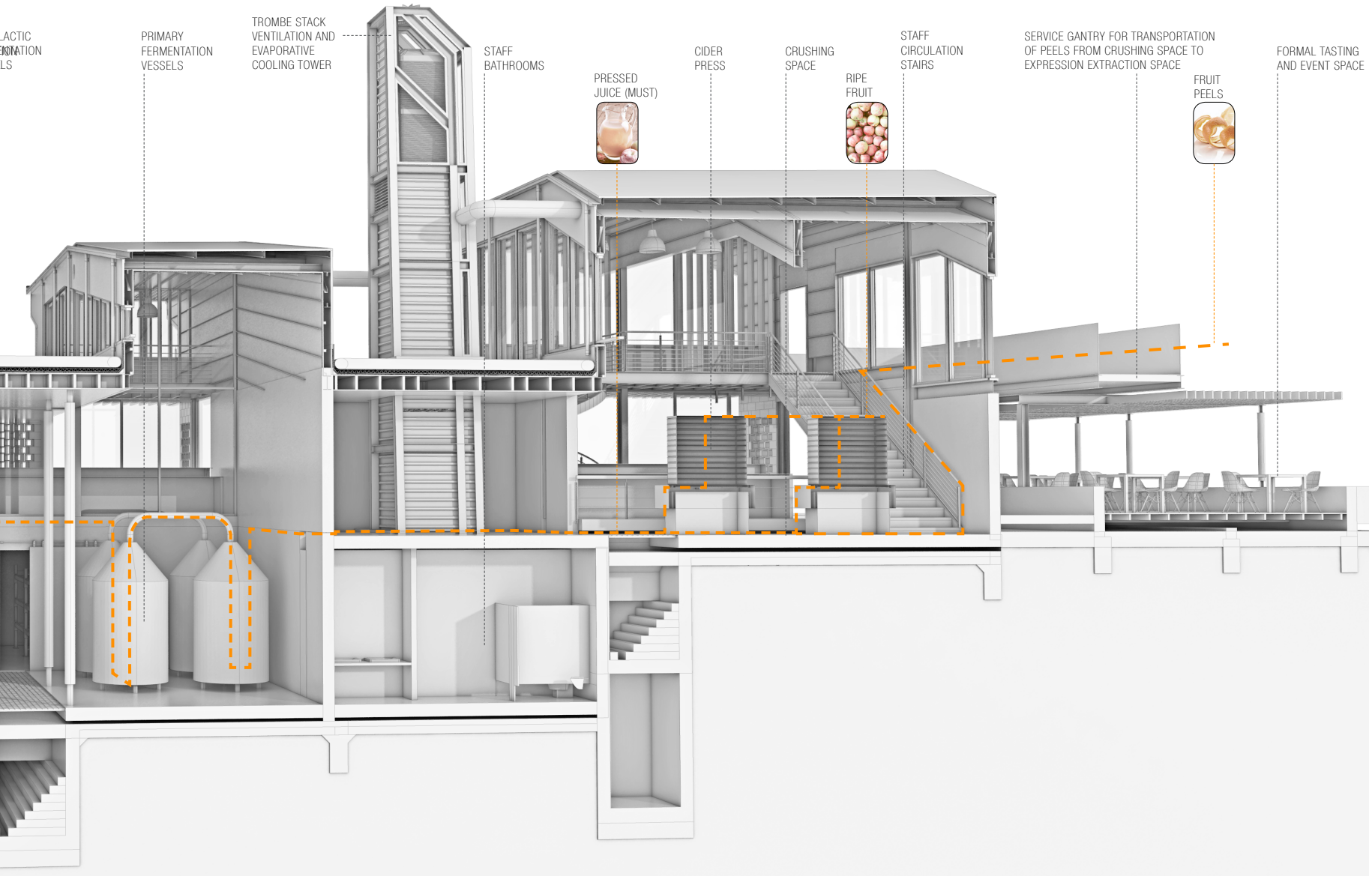
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SPATIAL SECTION C-C/ A REINSERTION INTO THE SCARRED LANDSCAPE THE CIDER-MAKING COMPONENT_ SHOWING THE PRODUCTION PROCESSES AND FLOW OF MATERIAL



7.44 _ Spatial section C-C showing the production processes and flow of material (Author: 2014).

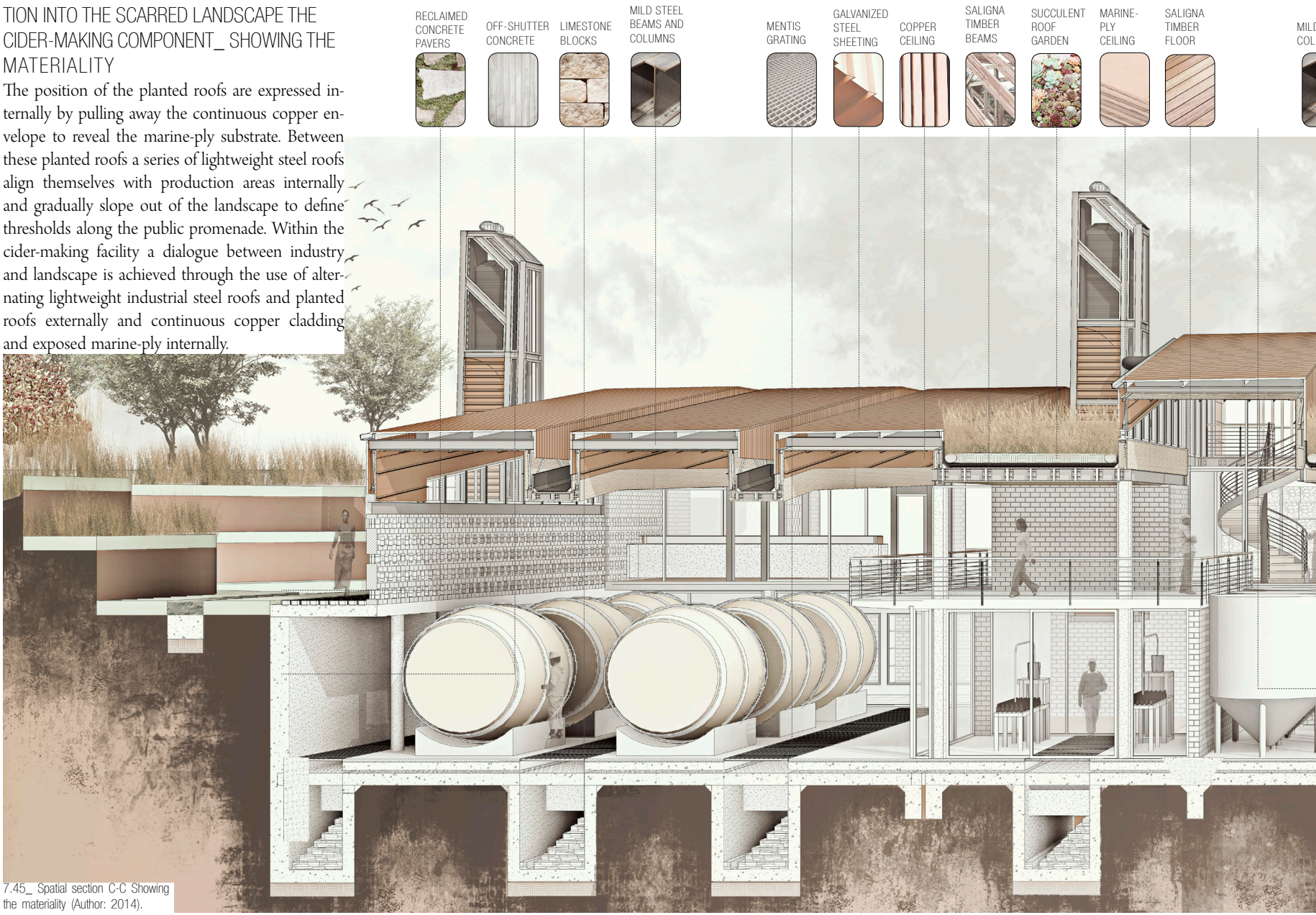
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SPATIAL SECTION C-C/ A REINSERTION INTO THE SCARRED LANDSCAPE THE CIDER-MAKING COMPONENT_ SHOWING THE MATERIALITY

The position of the planted roofs are expressed internally by pulling away the continuous copper envelope to reveal the marine-ply substrate. Between these planted roofs a series of lightweight steel roofs align themselves with production areas internally and gradually slope out of the landscape to define thresholds along the public promenade. Within the cider-making facility a dialogue between industry and landscape is achieved through the use of alternating lightweight industrial steel roofs and planted roofs externally and continuous copper cladding and exposed marine-ply internally.



7.45_ Spatial section C-C Showing the materiality (Author: 2014).

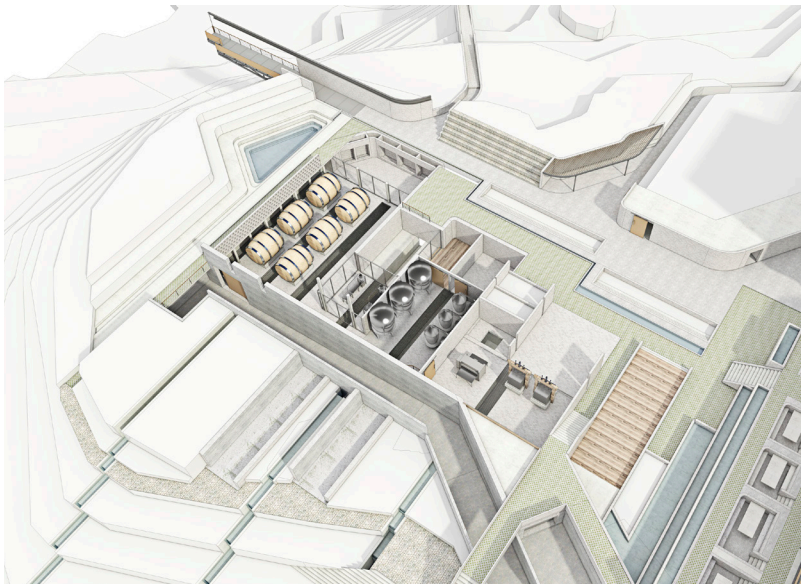
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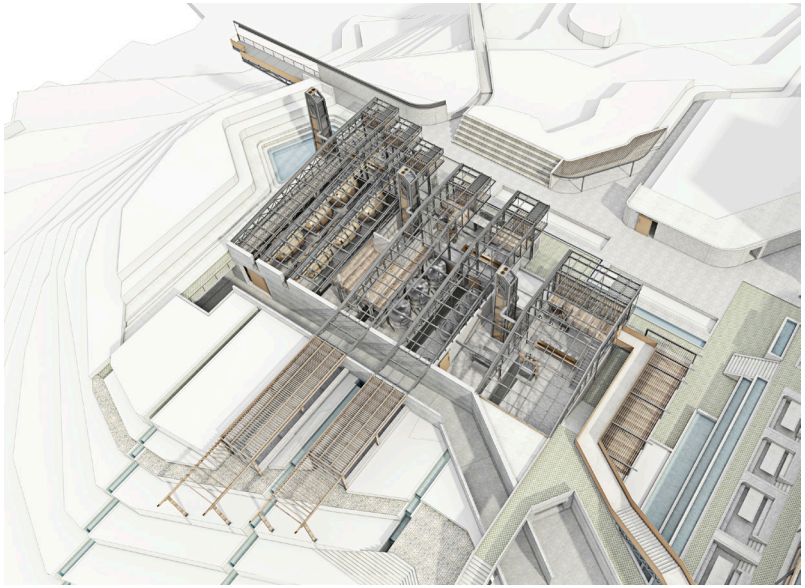
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CONSTRUCTION SEQUENCE / CIDER-MAKING FACILITY

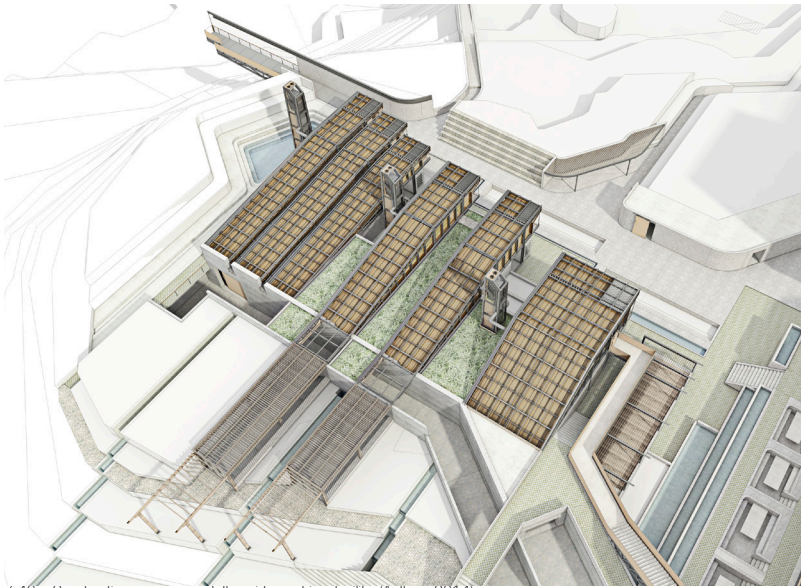
01_EXCAVATIONS AND SUB STRUCTURE



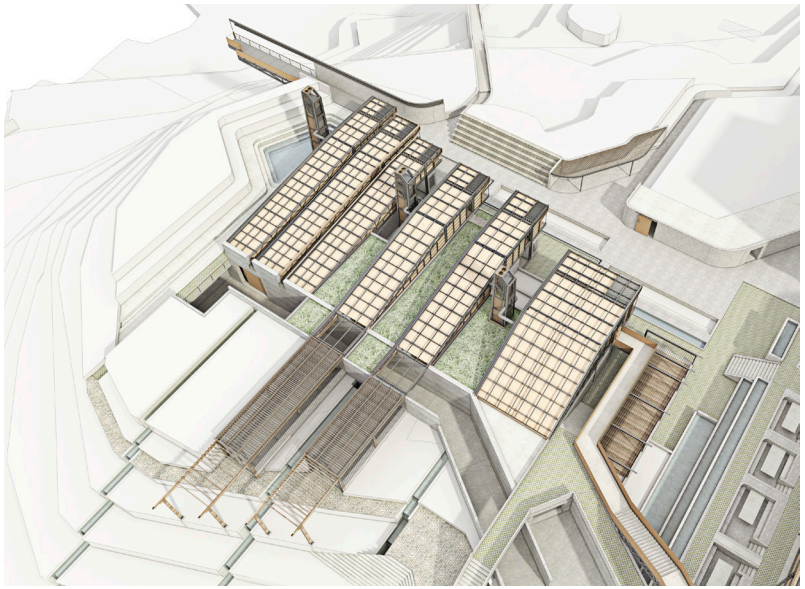
02_PRIMARY STEEL STRUCTURE



03_COPPER CEILING INTERNAL ENVELOPE, LIGHTWEIGHT PLANTED ROOFS AND GUTTERS



04_SECONDARY STEEL STRUCTURE AND PLYWOOD SUBSTRATE

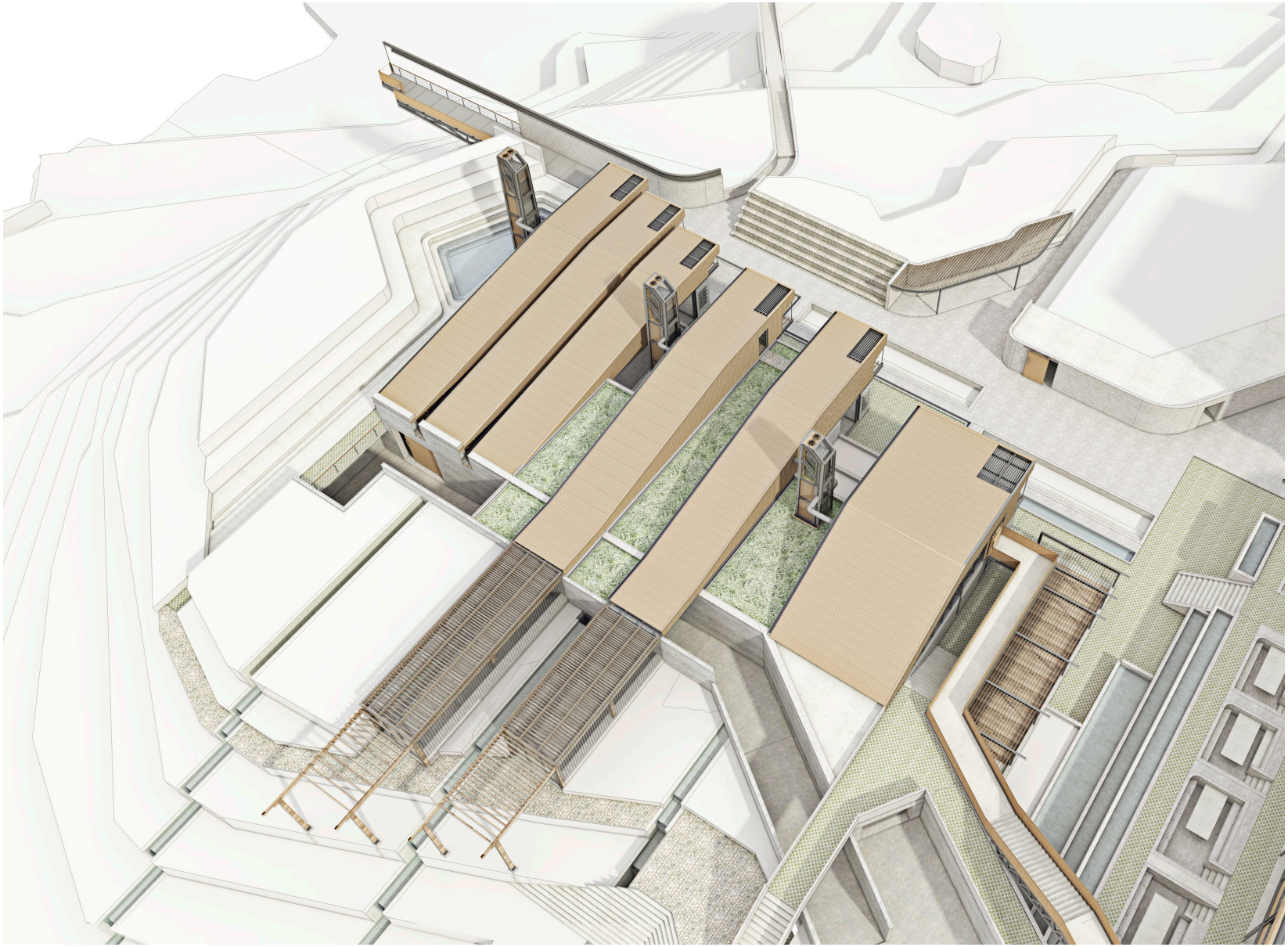


7.46_ Construction sequence of the cider-making facility (Author: 2014).

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CONSTRUCTION SEQUENCE / CIDER-MAKING FACILITY

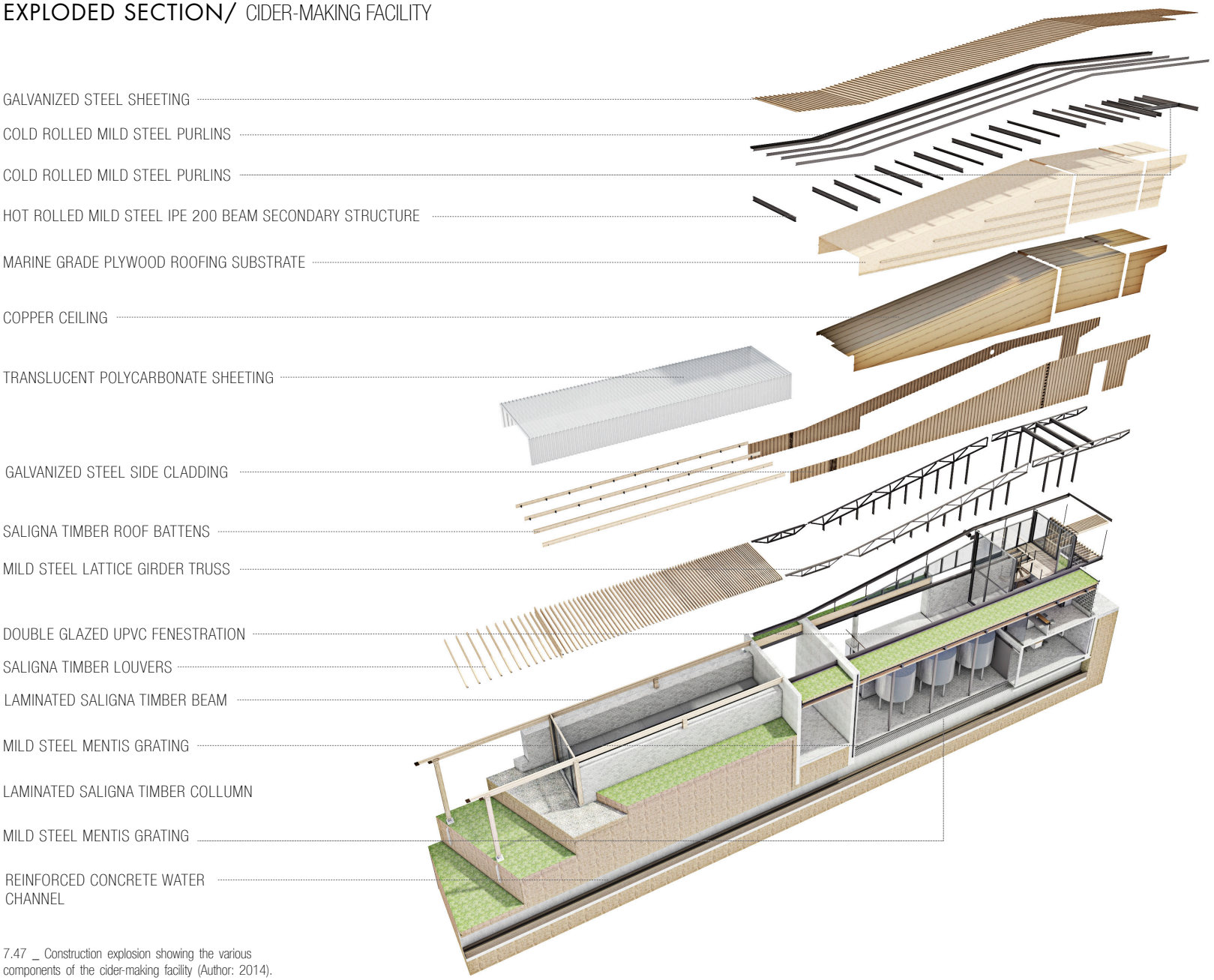
05_GALVANIZED SHEET METAL CLADDING AS PROTECTIVE EXTERIOR ENVELOPE



7.46_ Construction sequence of the cider-making facility (Author: 2014).

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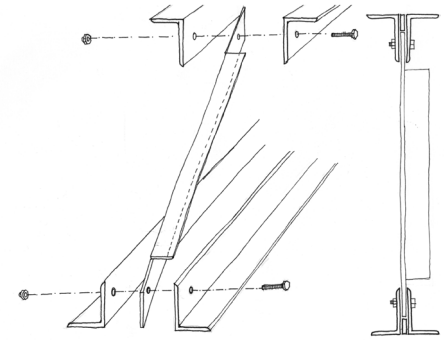
EXPLODED SECTION/ CIDER-MAKING FACILITY



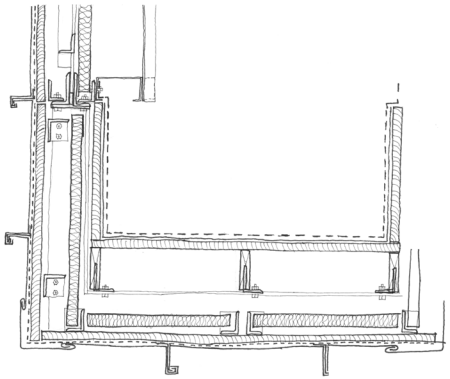
7.47 _ Construction explosion showing the various components of the cider-making facility (Author: 2014).

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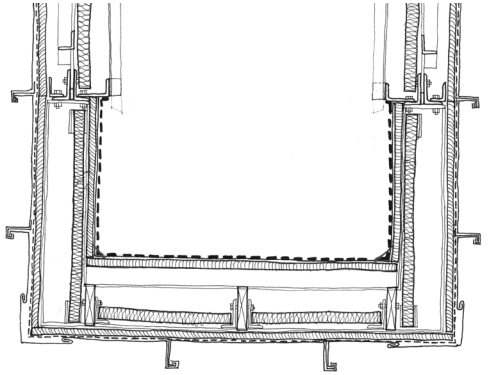
DETAIL DEVELOPMENT/ EXPLORING THE TECTONIC CONCEPT OF INSERTION



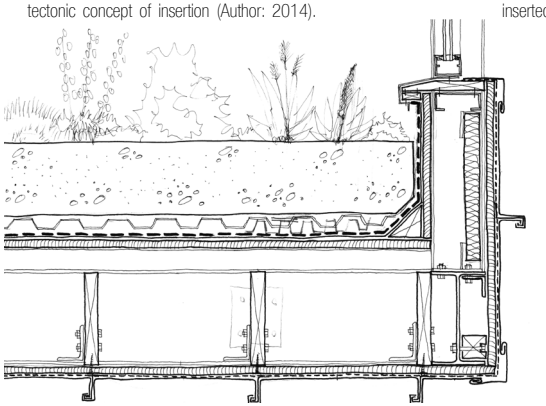
7.48 _ Exploring the components and assembly of the steel lattice girder truss in the cider-making facility as an expression of the tectonic concept of insertion (Author: 2014).



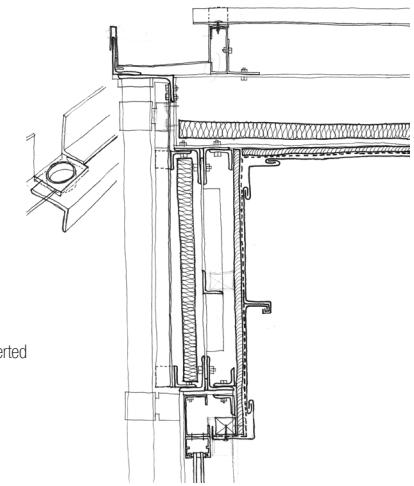
7.51 _ Detail development of the gutter in the fermentation space of the cider-making facility to explore how the structure can be inserted in between the external and internal skins (Author: 2014).



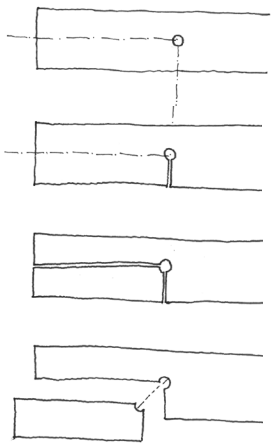
7.53 _ Detail development of the gutter in the fermentation space of the cider-making facility exploring a different method of achieving the required fall (Author: 2014).

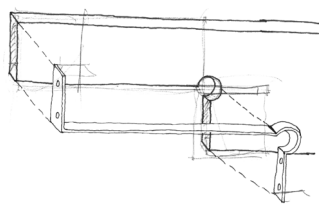


7.49 _ Detail development of the lightweight planted roof exploring how the structure is inserted in-between the external plywood substrate and internal copper ceiling _ (Author: 2014).

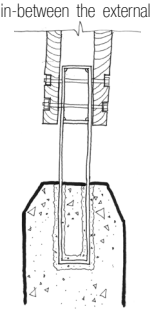


7.52 _ Detail development of the roof edge of the cider-making facility showing how the structure is insreted between the external and internal skins (Author: 2014).

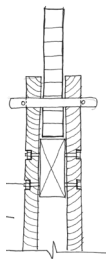




7.54 _ Sequence of manufacturing of the greenhouse beam (Author: 2014).



7.50 _ Exploring the tectonic concept of insertion in the detailing of the column and footing connection of the greenhouse (Author: 2014).



7.55 _ Exploring how the greenhouse beam is inserted between the two timber columns (Author: 2014).

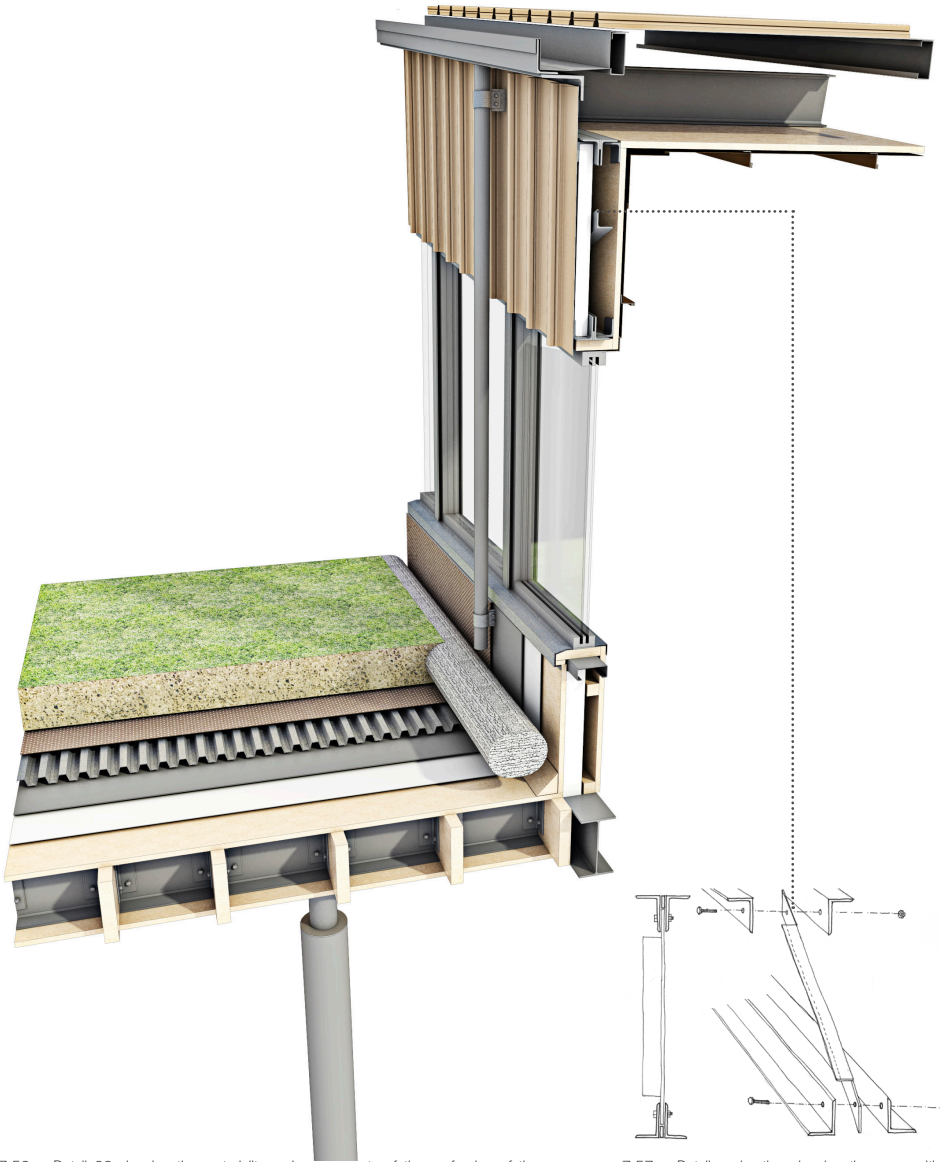
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DETAIL 02/ ROOF EDGE OF CIDER-MAKING FACILITY

The assembly of the steel girder truss embodies the concept of reinsertion by means of utilizing a steel equal leg angle as a web member which is cut away at the ends, allowing it to be inserted into the chord members (see **Figure 7.57**). These chord members consist of two unequal leg angles welded to each other with a spacer as separating element. Furthermore, the tectonic theme of insertion is evident in that the structure of the roof is inserted in between a protective external skin of galvanized IBR sheeting and a slow-weathering internal copper skin as shown in **Figure 7.56.** The copper cladding consists of 300mm wide trays with a 100mm strip of copper as a seam, fixed with brass screws to a 22mm marine-ply substrate at 300mm centers. Due to the fact that the copper ceiling is hanging from the substrate instead of being placed on top of it, as is usually the case with copper roofs, a 300mm tray is utilized instead of a 600mm tray. This allows the copper ceiling trays to be fixed at more regular intervals, preventing the trays from sagging or loosening and falling from the roof. A double standing seam is additionally utilized to ensure proper fixing of the trays, and to emphasize the flow and linearity of the roof within the space.

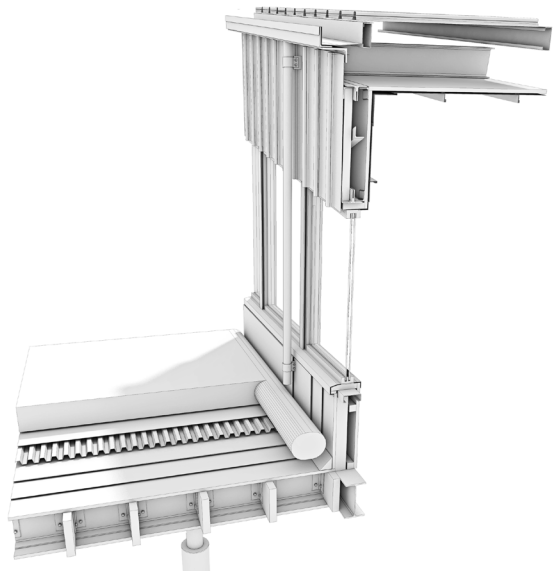
01_MATERIALITY



7.56 _ Detail 02 showing the materiality and components of the roof edge of the cider-making facility and the lightweight planted roof (Author: 2014).

7.57 _ Detail exploration showing the composition of the steel lattice girder truss (Author: 2014).

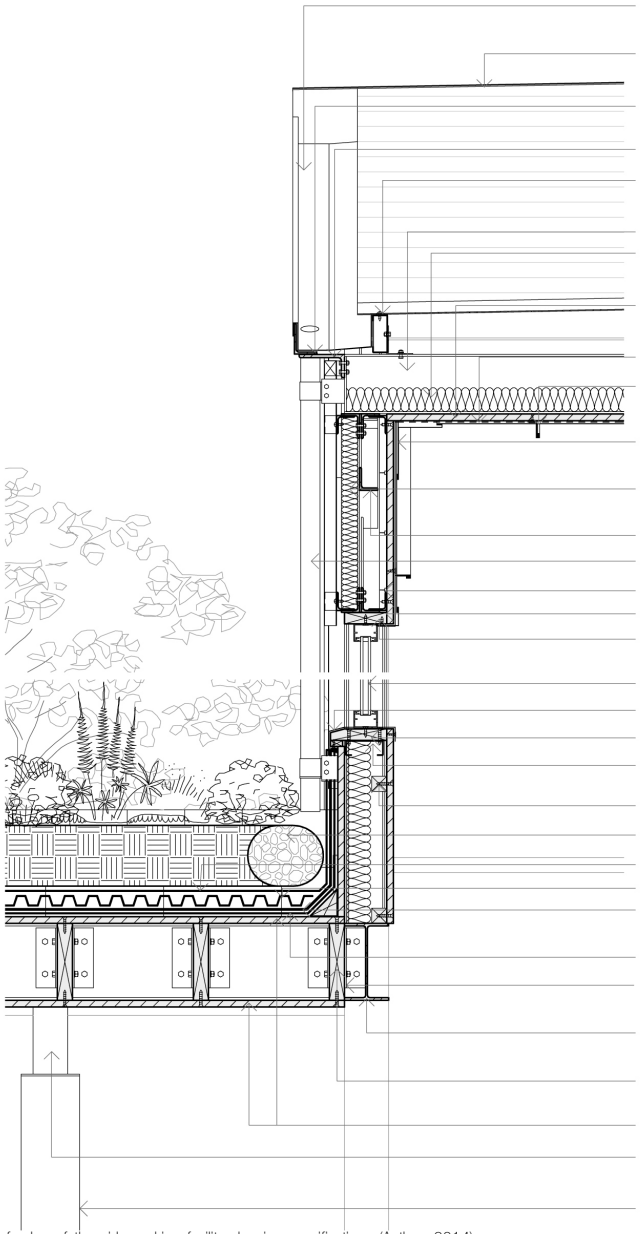
02_CONNECTIONS



7.58 _ Showing how the different structural components are inserted in-between the external and internal envelopes to give expression to the concept of insertion (Author: 2014).

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DETAIL 02/ ROOF EDGE OF CIDER-MAKING FACILITY



245 x 90 x 0.6mm purpose made galvanized mild steel gutter with min 1:100 fall towards 60mm dia. Hot rolled galvanized mild steel circular hollow section downpipe's @ 2400 centers

Concealed Fix Klip-Lok 700 0.5mm thick light industrial Z450 spelter galvanized steel sheeting and accessories fixed to 125X50X20X3 Galvanized mild steel cold formed lipped channel purlins at 1200mm centers

100 x 75 x 6 mm Hot rolled galvanized unequal leg angle pre-welded to 150 x 50 x 10 mm Hot rolled galvanized unequal leg angle

150 x 50 x 10 mm Hot rolled galvanized unequal leg angle bolted to IPE 200 hot rolled galvanized steel beam

125X50X20X3 Galvanized mild steel cold formed lipped channel purlins at 1200mm fixed to IPE 200 hot rolled galvanized steel beam

IPE 200 hot rolled galvanized steel beam fixed @ 2400 centers to steel roof girder.
80mm SAGEX KULITE Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U – value of 0.31W W/m2. °C to be laid on top of 22mm Sa marine-ply substrate

22mm Sa marine-ply substrate fixed @ 1200mm centers to IPE 200 hot rolled galvanized steel beams and 125X50X20X3 Galvanized mild steel cold formed lipped channels with brass screws

Breather membrane fixed to 22mm Sa marine-ply substrate

610 X 2400 X 0.6mm standing seam copper sheeting tray on breather membrane underlay seam clamped @ 515mm centers with 30 x 0.6 copper ties fixed to 22mm Sa marine-ply sub-layer with brass screws

150 x 150 x 0.6mm copper corner seam on breather membrane underlay fixed to 22mm Sa marine-ply sub-layer with brass screws

60mm Sagex Kulite Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U – value of 0.31W W/m2. °C to be laid between 60 x 80 x 6 mm Hot rolled gms unequal leg angles of steel girder.

60 x 60 x 6 mm Hot rolled galvanized unequal leg angle.

60mm dia. Hot rolled galvanized mild steel circular hollow section downpipe @ 2400 centers

60 x 60 x 6 mm Hot rolled galvanized unequal leg angle.

60 x 80 x 6 mm Hot rolled galvanized unequal leg angle.

140 x 38 Saligna screwed to IPE 140 hot rolled galvanized steel profile. Treated with Woodoc 5 Polywax sealer. Beam cut to slot into IPE 140

1200 x 1000mm uPVC window with double glazing screwed at head and sill according to manufacturers specifications

0,6mm Purpose made copper flat sheet window sill screwed to 185 x 38 Saligna sill

185 x 38 Saligna sill screwed to channel below and treated with Woodoc 5 Indoor Polywax Sealer (Matt finish)

125 x 50 x 3mm Galvanized mild steel cold formed lipped channel bolted to IPE 140 hot rolled galvanized steel beam

50 x 50mm Treated SA Pine timber battens fixed to IPE 140

Smooth pebbles with max 25mm dia. wrapped in polyester geotextile to protect top soil against rainwater flow

Kaytech bidim A2 non-woven continuous filament needle-punched polyester geotextile

m520p drainage core laid horizontally on waterproofing

One layer Derbigum SP4 waterproofing membrane, with 75mm side laps and 100mm end laps, sealed to one layer index adhering membrane

Index adhering membrane laid onto 22mm Sa marine-ply

70 x 70 x 200mm hot rolled galvanized steel equal leg angle bolted to 254x 146 x 31 mm Hot rolled galvanized steel I profile beam with M10 machine bolts

254x 146 x 31 mm Hot rolled galvanized steel I profile beam bolted to 254x 146 x 31 mm Hot rolled galvanized steel I profile beam @ 3250mm centers

50 x 255 mm Treated Sa Pine timber beams @ 450mm centers with a minimum fall of 1:100 to drainage spouts bolted to 70 x 70 x 200mm hot rolled galvanized steel equal leg angle with M10 machine bolts

22mm Sa marine-ply fixed to 50 x 255 mm Treated Sa Pine timber beams @ 450mm centers with brass wood screws

114 x 6mm Hot rolled galvanized mild steel circular hollow section shop welded to 140 x 140 x 6mm mild steel flatplate bolted to 254x 146 x 31 mm hot rolled galvanized steel I profile beam

193,7 x 6mm Hot rolled galvanized mild steel circular hollow section column shop welded to 114 x 6mm Hot rolled galvanized mild steel circular hollow section

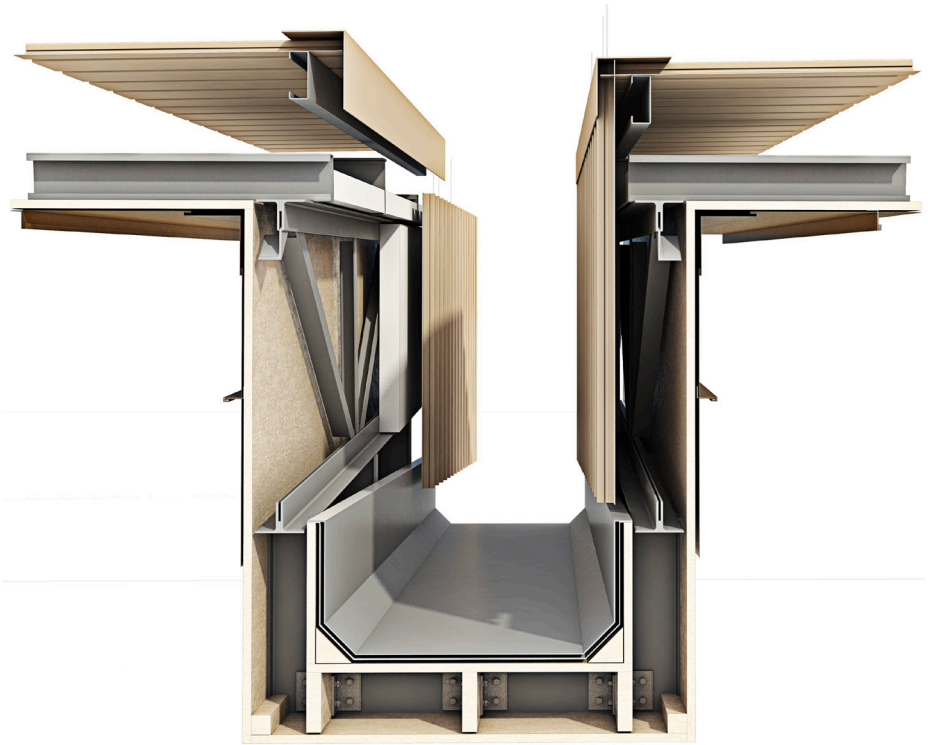
7.59_ Detail 02 of the roof edge of the cider-making facility showing specifications (Author: 2014).

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DETAIL 03/ THE GUTTER IN THE FERMENTATION SPACE OF CIDER-MAKING FACILITY

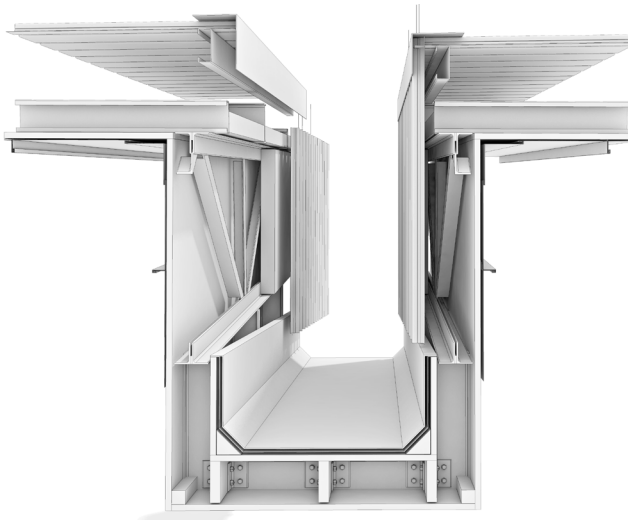
The gutters of the fermentation spaces of the cider-making facility shown in **Figure 7.60**, consists of a 4mm bituminous waterproofing membrane applied to an adherence membrane laid on a 22mm marine-ply substructure. The substructure is fixed to saligna timber beams that are bolted to IPE 140 structural steel beams. The copper used as a ceiling in the cider-making facility is durable and highly resistant to corrosion, building up a protective patina that requires no maintenance in the humid environment of the production spaces. It is also sufficiently resistant to the slight chemical abrasion it will be subjected to when carbon dioxide, released during fermentation, combines with water vapour in the air to form a weak acid. The slow weathering of the copper reflects the internal production processes of fermentation and maturation, and allows the roof to gradually change over time and, in a sense, mature and develop in character in conjunction with the cider.

01_MATERIALITY



7.60 _ Detail 03 showing the materiality and components of the gutter of the cider-making facility (Author: 2014).

02_CONNECTIONS

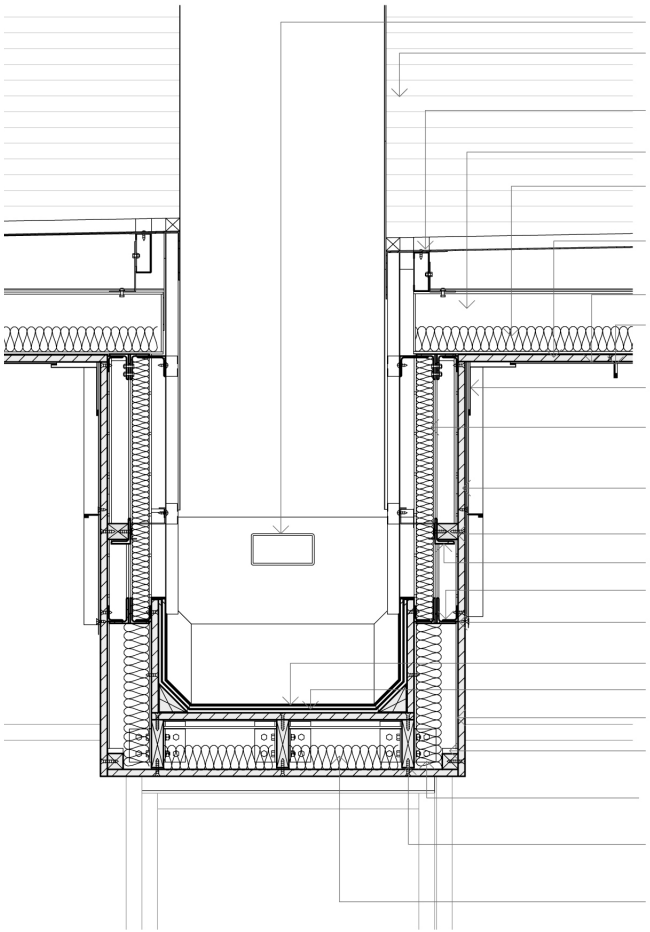


7.61 _ Showing how the different structural components are inserted in-between the external and internal envelopes to give expression to the concept of insertion (Author: 2014).

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DETAIL 03/ THE GUTTER IN THE FERMENTATION SPACE OF CIDER-MAKING FACILITY Y

03_SPECIFICATIONS



200X100X6mm Galvanized mild steel cold formed rectangular hollow section overflow spout

Concealed Fix Klip-Lok 700 0.5mm thick light industrial Z450 spelter galvanized steel sheeting and accessories fixed to 125X50X20X3 Galvanized mild steel cold formed lipped channel purlins at 1200mm centers

125X50X20X3mm Galvanized mild steel cold formed lipped channel purlins at 1200mm fixed to IPE 200 hot rolled galvanized steel beam

IPE 200 hot rolled galvanized steel beam fixed @ 2400 centers to steel roof girder.

80mm SAGEX KULITE Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U - value of 0.31W W/m2. °C to be laid on top of 22mm Sa marine-ply substrate

22mm SA marine-ply substrate fixed @ 1200mm centers to IPE 200 hot rolled galvanized steel beams and 125X50X20X3 Galvanized mild steel cold formed lipped channels with brass screws

Breather membrane fixed to 22mm Sa marine-ply substrate

610 X 2400 X 0.6mm standing seam copper sheeting tray on breather membrane underlay seam clamped @ 515mm centers with 30 x 0.6 copper ties fixed to 22mm Sa marine-ply sub-layer with brass screws

150 x 150 x 0.6mm corner seam on breather membrane underlay fixed to 22mm SA marine-ply sub-layer with brass screws

60mm Sagex Kulite Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U - value of 0.31W W/m2. °C to be laid between 60 x 80 x 6 mm Hot rolled gms unequal leg angles of steel girder.

22mm SA marine-ply sub-layer with fixed to 60 x 60 x 6 mm Hot rolled galvanized equal leg angle with brass screws

76 x 50mm Treated SA Pine timber battens screwed to 60 x 60 x 6 mm Hot rolled galvanized equal leg angle

60 x 60 x 6 mm Hot rolled galvanized equal leg angle.

60 x 60 x 6 mm Hot rolled galvanized equal leg angle.

60 x 80 x 6 mm Hot rolled galvanized unequal leg angle.

One layer Derbigum SP4 waterproofing membrane, with 75mm side laps and 100mm end laps, sealed to one layer index adhering membrane

Index adhering membrane laid onto 22mm Sa marine-ply sub-layer

22mm Sa marine-ply screwed to 38 x 152 mm Treated Sa Pine timber beams @ 450mm centers

IPE 140 hot rolled galvanized steel beam

70 x 70 x 200mm hot rolled galvanized steel equal leg angle bolted to IPE 140 hot rolled galvanized steel beam

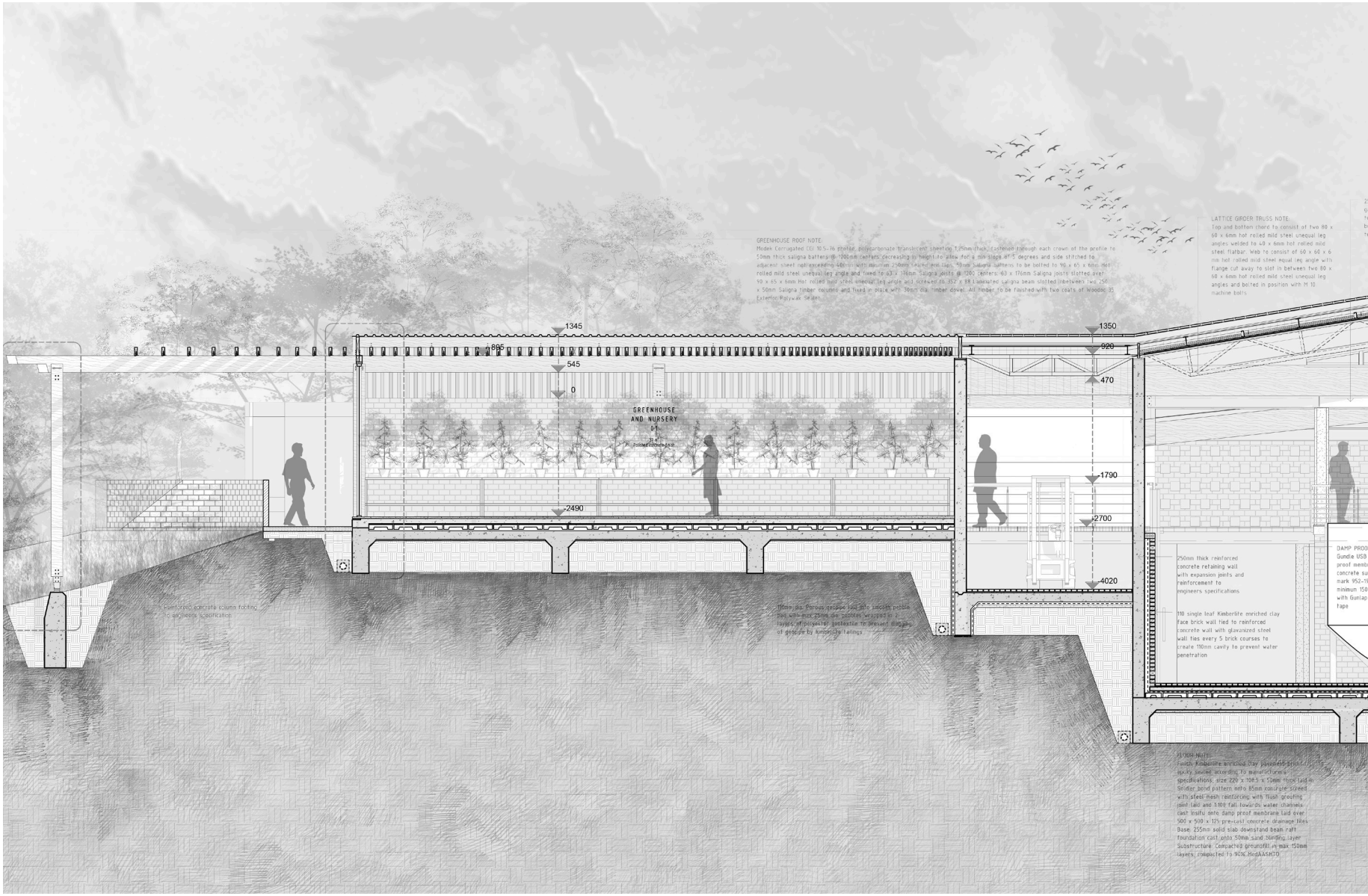
38 x 152 mm Treated Sa Pine timber beams @ 450mm centers with a minimum fall of 1:50 towards orchards bolted to 70 x 70 x 100mm hot rolled galvanized steel equal leg angle with M10 machine bolts

80mm Sagex Kulite Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U - value of 0.31W W/m2. °C fixed to 50 x 50mm Treated SA Pine timber battens

7.62_ Detail 03 of the gutter in the cider-making facility showing specifications (Author: 2014).

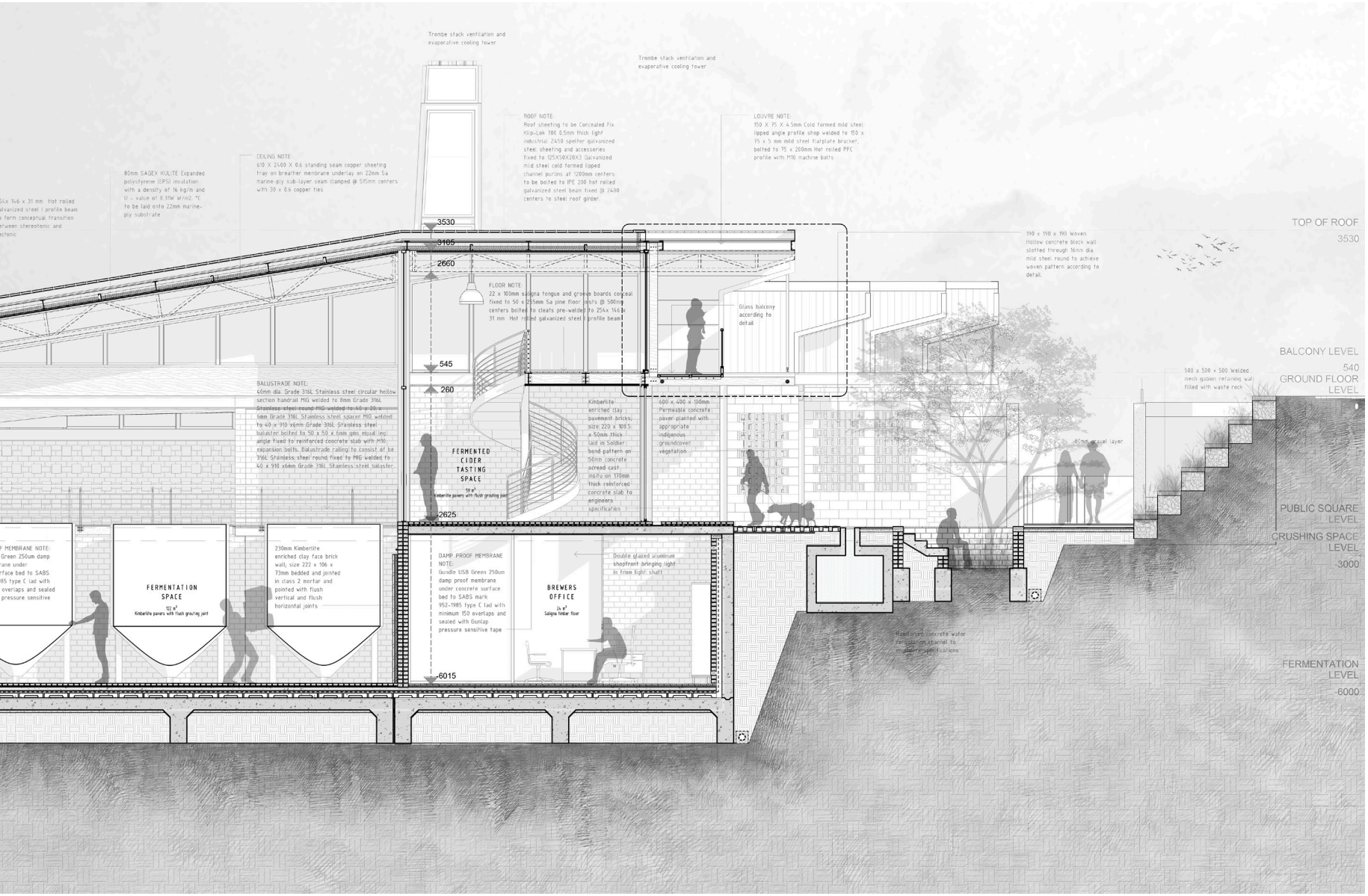
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SECTION D-D/ RECONCILING INDUSTRY AND THE LANDSCAPE



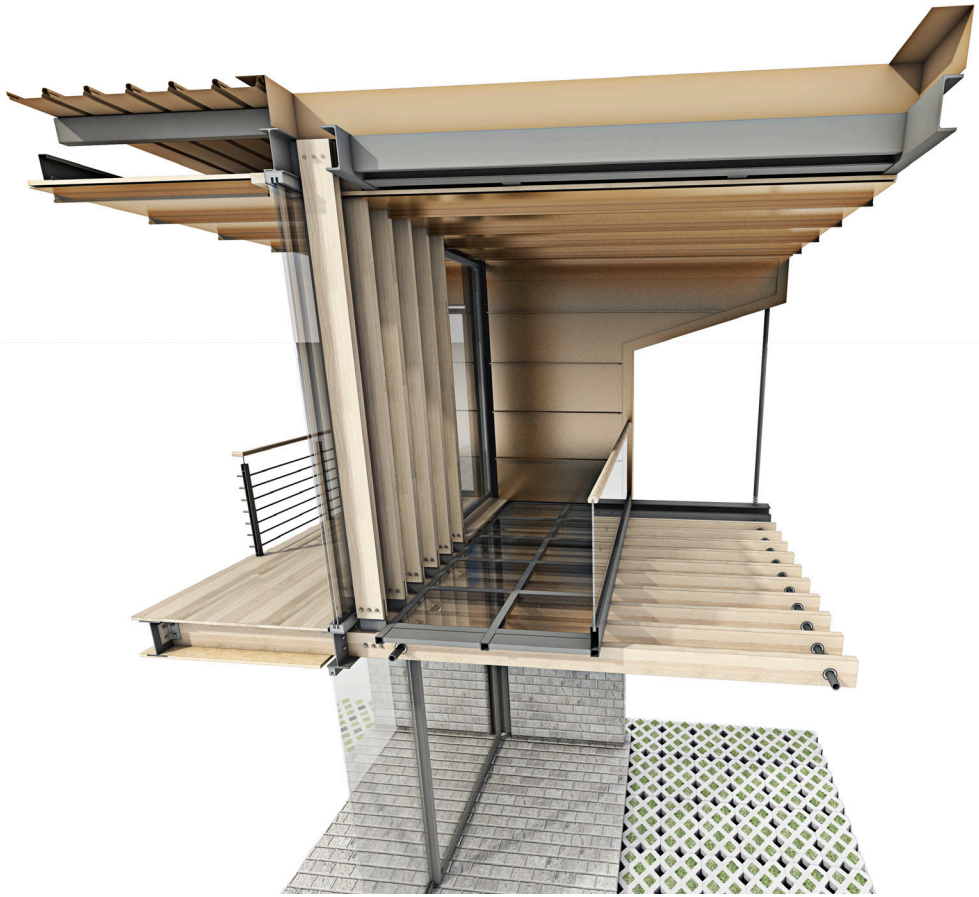
7.63_ Section D-D Showing the relationship between the natural landscape, the cider-making facility and the scarred landscape (Author: 2014).

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01_MATERIALITY



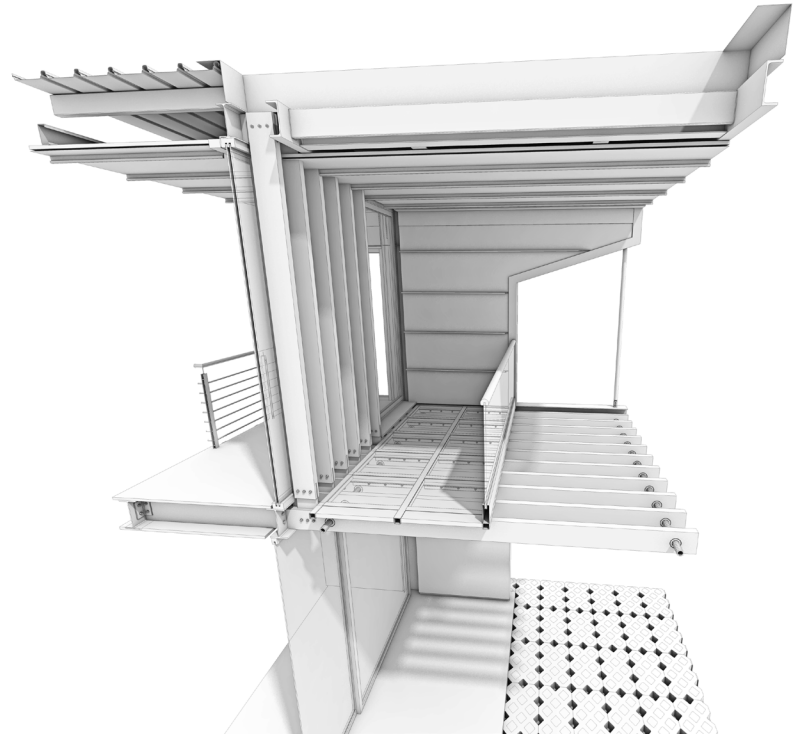
7.64_ Detail 04 showing the materiality and components of the balcony and threshold of the cider-making facility(Author: 2014).

DETAIL 04/ BALCONY AND THRESHOLD OF THE CIDER-MAKING FACILITY

The balcony of the cider-making facility shown in **Figure 7.64,** expresses the concept of insertion through its assembly and construction. This is achieved by using a base component that is inserted through the floor structure to function as its structural support. This base component consists of a mild-steel circular hollow section onto which steel washers are systematically tack welded at a spacing of 250mm, after which the circular hollow section is inserted through a pre-drilled hole in the corresponding saligna timber louver. The timber louver is then positioned to slot over the washer, which acts as a spacer, and is fixed in position with a suitable epoxy glue. This process is repeated until each timber louver is fixed to the steel circular hollow section. The resulting louvered framework, with the steel circular hollow sections as base structure, is then placed into mild steel equal leg angles which are pre-welded to structural I-beams. These I-beams, which extend outwards from the building, are connected to the steel lattice girder truss of the roof by means of a suspended connection. The suspended connection involves the use of a 48mm diameter steel circular hollow section as the element in tension with a bolted connection to the roof truss and I-beam. A balcony with a glass floor is constructed to rest on the timber louver framework, which functions both as floor joists and as a shading device.

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02_CONNECTIONS

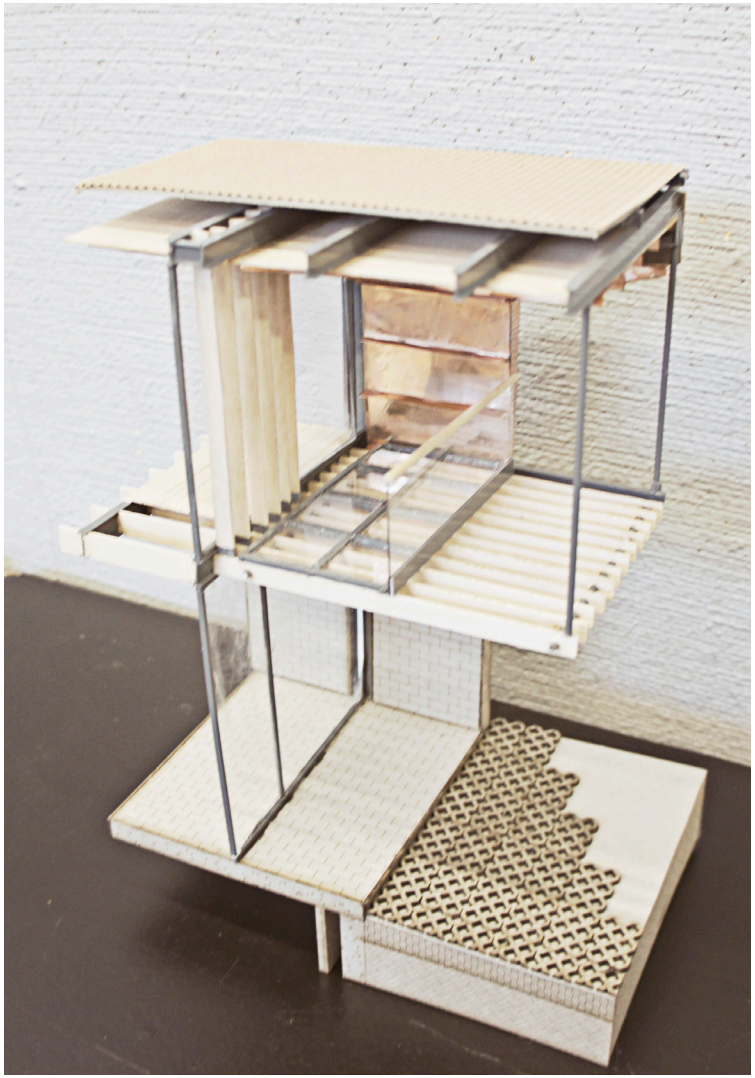


7.65_ Showing how the various connections express the tectonic theme of insertion (Author: 2014).



7.66_ Showing a prototype of the connection detail (Author: 2014).

03_PROTOTYPE

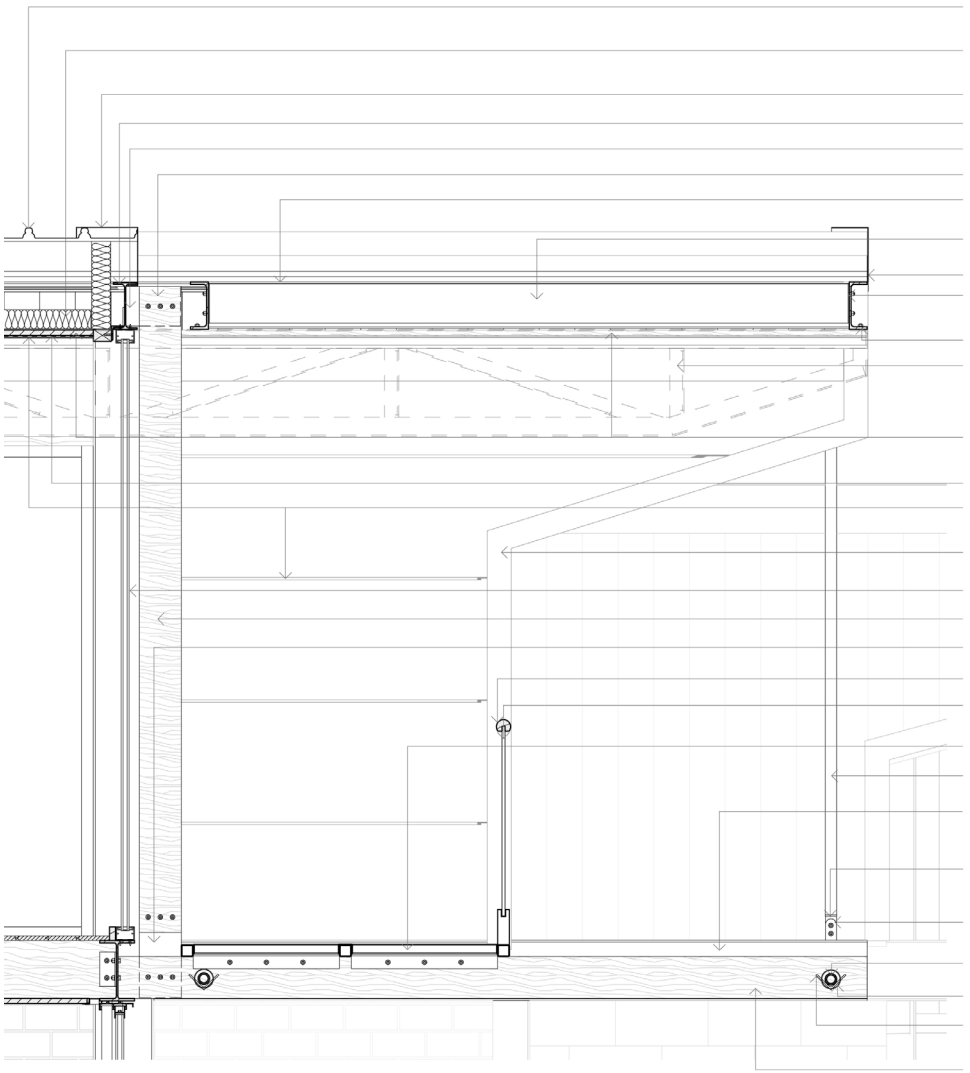


7.67_ Showing a prototype of the connection detail (Author: 2014).

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04_SPECIFICATIONS

DETAIL 04/ BALCONY OF CIDER-MAKING FACILITY



Concealed Fix Klip-Lok 700 0.5mm thick light industrial Z450 spelter galvanized steel sheeting and accessories fixed to 125X50X20X3 Galvanized mild steel cold formed lipped channel purlins at 1200mm centers

80mm SAGEX KULITE Expanded polystyrene (EPS) insulation with a density of 16 kg/m and U - value of 0.31W W/m2. °C to be laid on top of 22mm Sa marine-ply substrate

260 x 250 x 0.6mm Galvanized mild steel cold formed Exterior corner trim

IPE 200 hot rolled galvanized steel beam bolted to steel lattice girder

235 x 165 x 6mm Flatplate flange pre-welded to IPE 200 hot rolled mild steel beam

176 X 50mm Saligna vertical louvers @ 250mm centers slotted into 235 x 165 x 6mm Flatplate flange and bolted in place

200 x 75mm Hot rolled galvanized mild steel taper flange channel bolted to steel lattice girder with M10 machine bolts

150 X 75 X 4.5mm Cold formed galvanized mild steel lipped angle profile louver shop welded to 150 x 75 x 5 mm mild steel flatplate bracket

260 x 250 x 0.6mm Galvanized mild steel cold formed Exterior corner trim

150 x 75 x 5 mm mild steel flatplate bracket bolted to 200 x 75mm Hot rolled galvanized mild steel taper flange channel with M 8 Machine bolts

200 x 75mm Hot rolled galvanized mild steel taper flange channel bolted to steel lattice girder with M10 machine bolts

LATTICE GIRDER TRUSS NOTE:
Top and bottom chord to consist of two 80 x 60 x 6mm hot rolled mild steel unequal leg angles welded to 40 x 6mm hot rolled mild steel flatbar. Web to consist of 60 x 60 x 6 mm hot rolled mild steel equal leg angle with flange cut away to slot in between two 80 x 60 x 6mm hot rolled mild steel unequal leg angles and bolted in position with M 10 machine bolts

22mm Sa marine-ply substrate fixed @ 1200mm centers to IPE 200 hot rolled galvanized steel beams and 125X50X20X3 Galvanized mild steel cold formed lipped channels

Breather membrane fixed to 22mm Sa marine-ply substrate

610 X 2400 X 0.6mm standing seam copper sheeting tray on breather membrane underlay seam clamped @ 515mm centers with 30 x 0.6 copper ties fixed to 22mm Sa marine-ply sub-layer with brass screws

100 x 235x 0.6 Copper corner seam fixed to Breather membrane fixed to 22mm Sa marine-ply substrate with brass screws

2570 x 1260mm uPVC window with double glazing screwed at head and sill to according to manufacturers specifications

176 X 50mm Saligna vertical louvers @ 250mm centers slotted into 235 x 165 x 6mm Flatplate flange and bolted in place

175 x 280 x 6mm Flatplate flange pre-welded to 254x 146 x 31 mm Hot rolled mild steel I profile beam

60 mm PAR Saligna Grade 7 circular handrail epoxy fixed to 12mm Laminated safety glass balustrade panel

12mm Laminated safety glass balustrade panel fixed to aluminum bottom rail to manufacturers specifications

Glass floor according to detail

48.4 x 4mm Hot formed mild steel circular hollow section shop welded to 45 x 90 x 6mm mild steel flatplate

254x 146 x 31 mm Hot rolled galvanized steel I profile beam fixed to 230 mm Kimberlite enriched masonry wall with M12 chemical anchors

45 x 90 x 6mm mild steel flatplate slotted into and bolted to 45 x 90 x 6mm mild steel flatplate flanges with M10 machine bolts

45 x 90 x 6mm mild steel flatplate flange shop welded to 254x 146 x 31 mm Hot rolled galvanized steel I profile beam

48.4 x 4mm Hot formed mild steel circular hollow section shop slotted into and tack welded to 90 x 90 x 6 hot rolled mild steel equal leg angle
75mm dia. x 5mm Mild steel washer tack welded to 48.4 x 4mm Hot formed mild steel circular hollow section

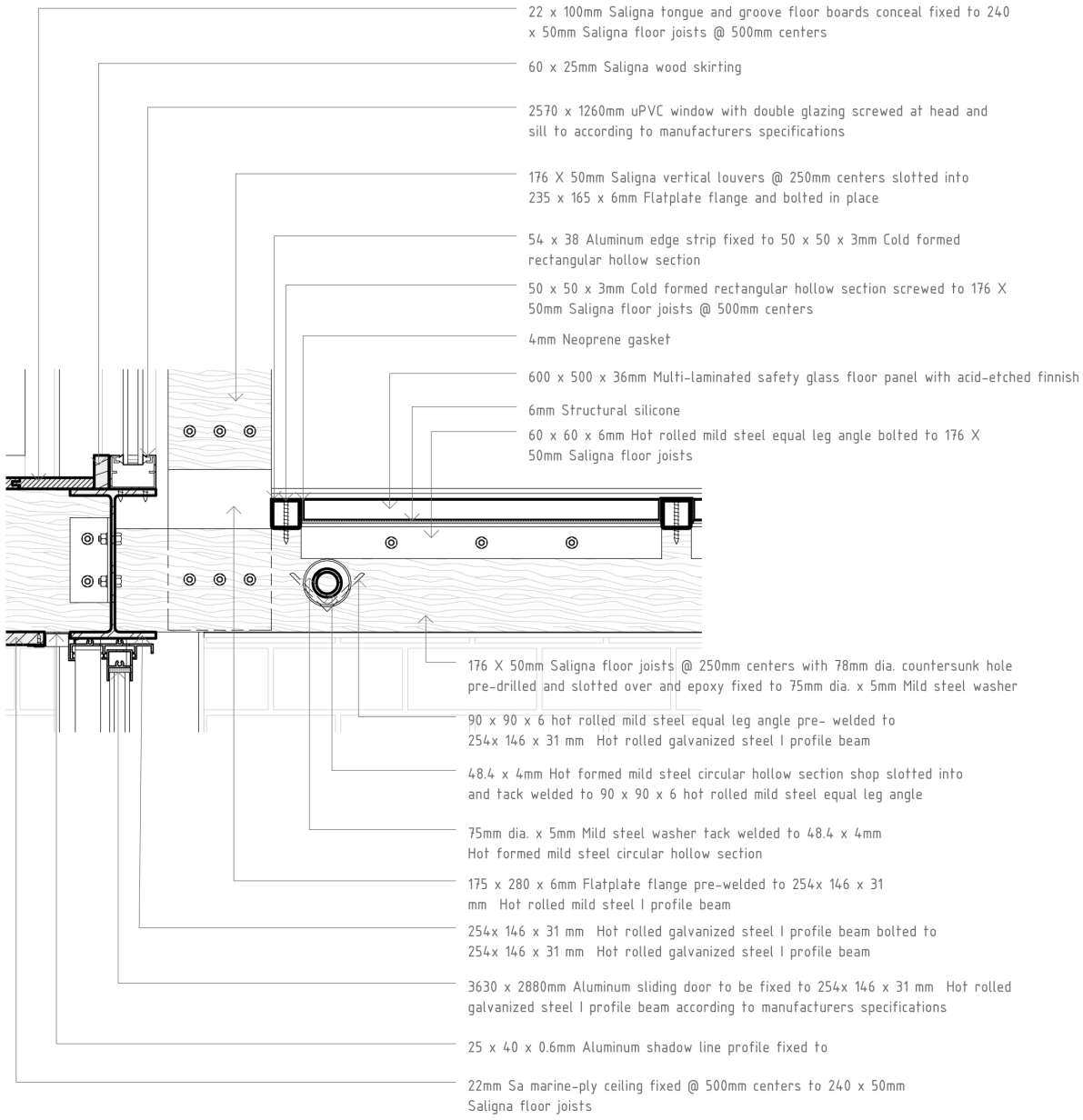
90 x 90 x 6 hot rolled mild steel equal leg angle pre- welded to 254x 146 x 31 mm Hot rolled galvanized steel I profile beam

176 X 50mm Saligna floor joists @ 250mm centers with 78mm dia. countersunk hole pre-drilled and slotted over and epoxy fixed to 75mm dia. x 5mm Mild steel washer

7.68_ Detail 04 of the balcony of the cider-making facility showing specifications (Author: 2014).

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DETAIL 05/ CONNECTION DETAILS OF THE BALCONY

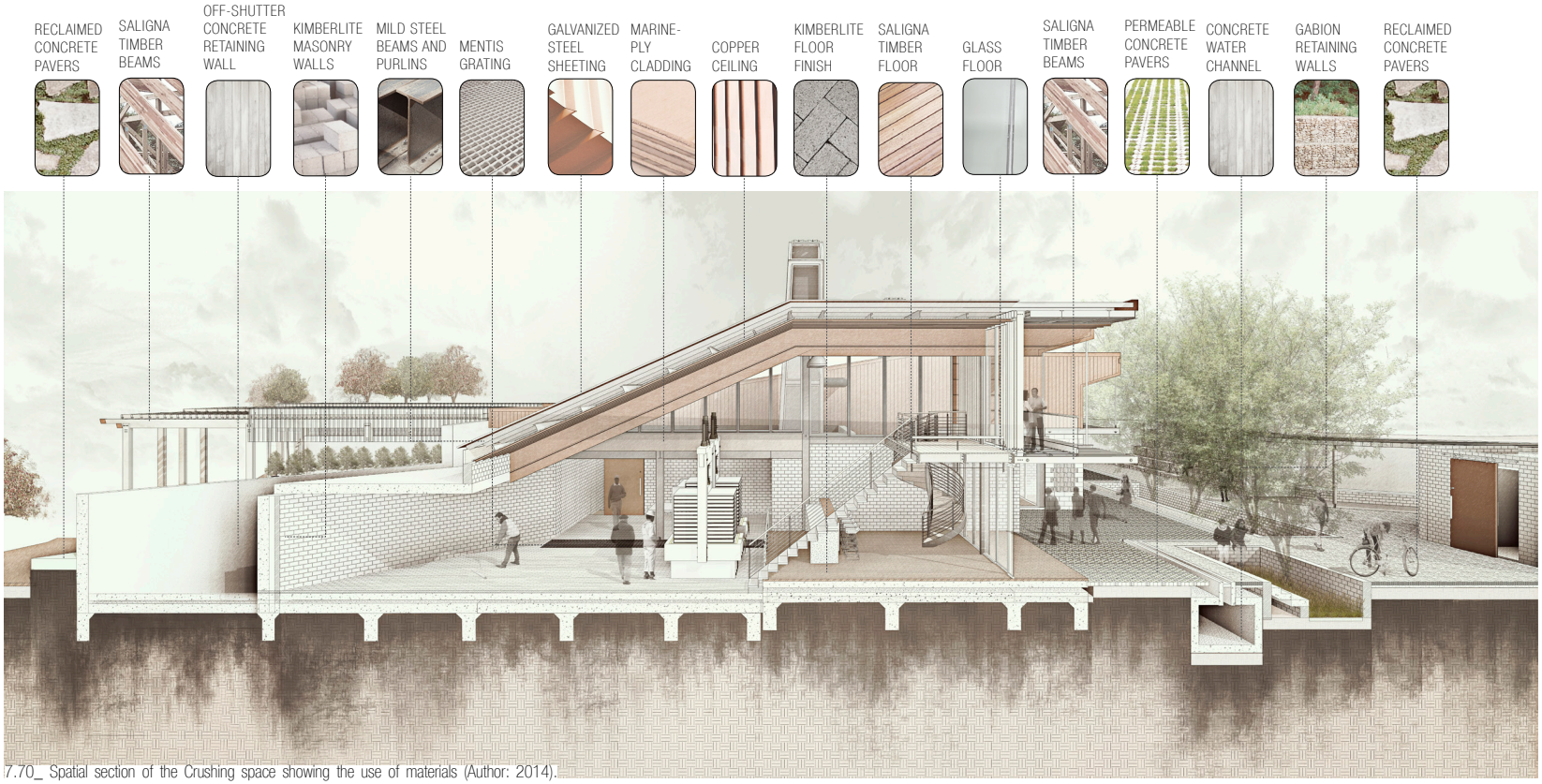


7.69_ Detail 05 showing the connection details of the

© University of Pretoria

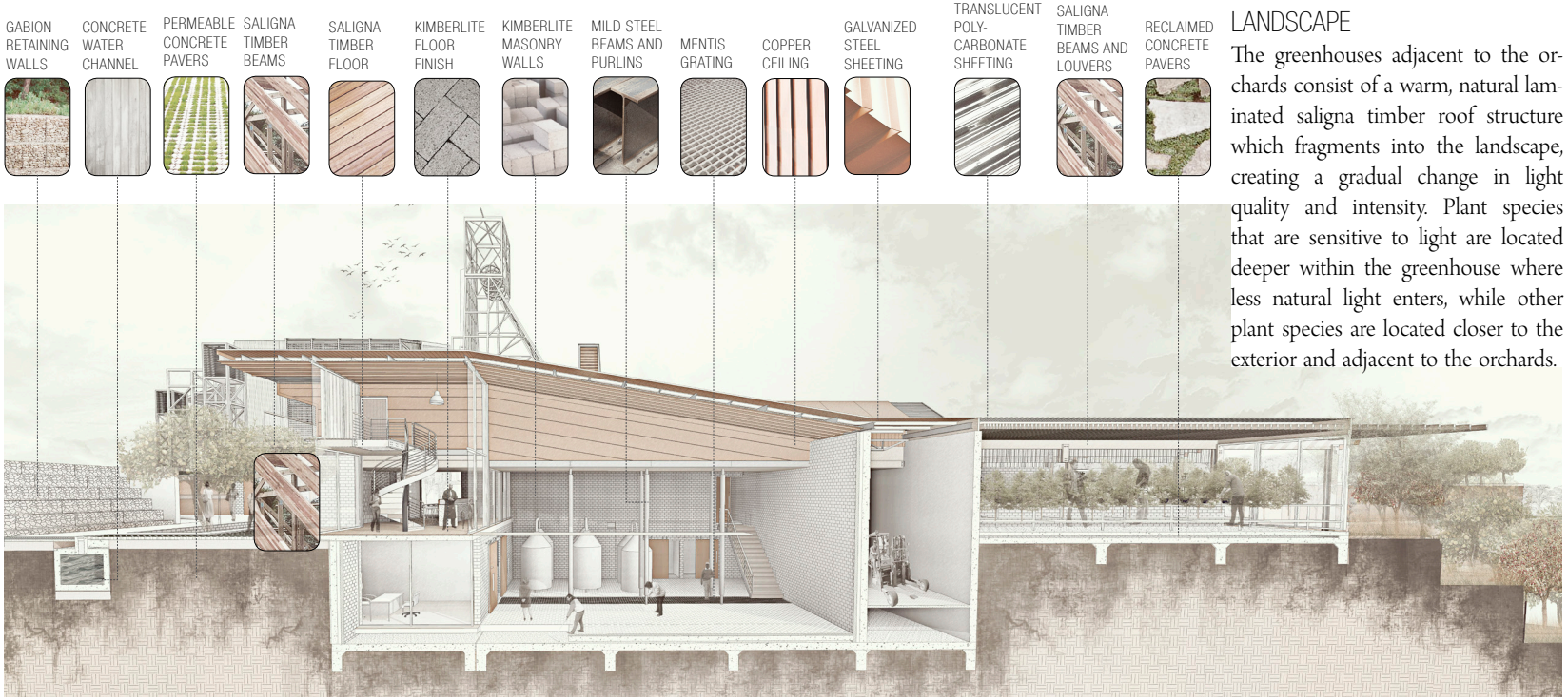
SPATIAL SECTION OF THE CRUSHING SPACE/
RECONCILING INDUSTRY AND THE LANDSCAPE

The materiality of the cider-making facility progresses from materials that express control over the landscape, as used along the public promenade through the scarred landscape, to materials that reflect the industrial character of the mine, as used in the submerged cider-making facility. The materials and construction methods employed along the public promenade express control over nature through the use of gabion retaining walls, perforated and reclaimed concrete pavers, submerged planters, and underground water reticulation channels. Durable materials that are resistant to corrosion and a measure of chemical abrasion, such as copper sheeting and treated marine grade plywood cladding, are used in the production spaces.



7.70_ Spatial section of the Crushing space showing the use of materials (Author: 2014).

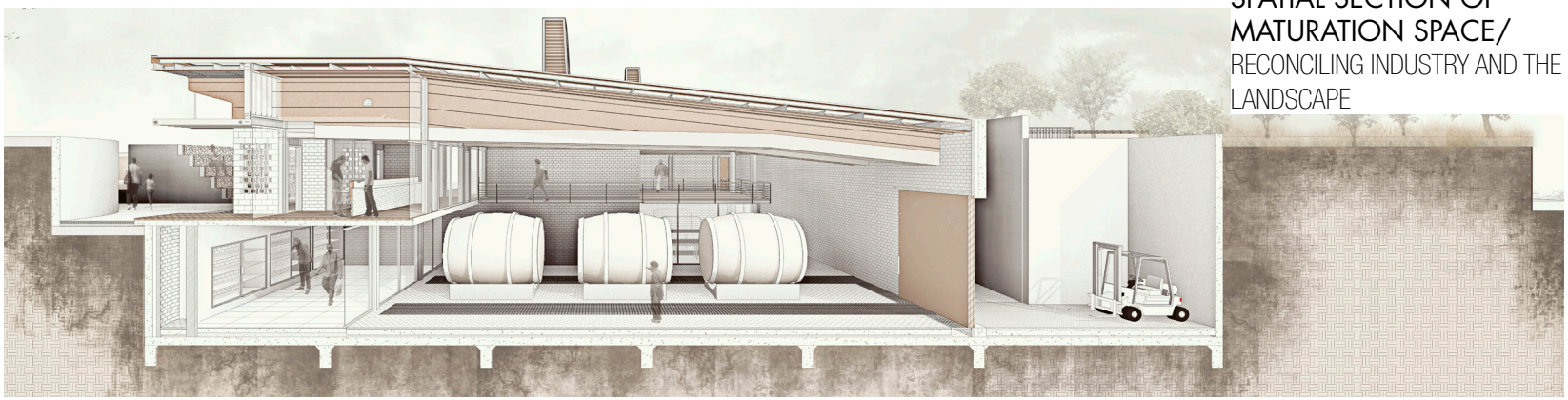
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SPATIAL SECTION OF FERMENTATION SPACE/ RECONCILING INDUSTRY AND THE LANDSCAPE

The greenhouses adjacent to the orchards consist of a warm, natural laminated saligna timber roof structure which fragments into the landscape, creating a gradual change in light quality and intensity. Plant species that are sensitive to light are located deeper within the greenhouse where less natural light enters, while other plant species are located closer to the exterior and adjacent to the orchards.

7.71_ Spatial section of the Fermentation space showing the use of materials (Author: 2014).



SPATIAL SECTION OF MATURATION SPACE/ RECONCILING INDUSTRY AND THE LANDSCAPE

7.72_ Spatial section of the Maturation space (Author: 2014).

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DETAIL 06/ GREENHOUSE COLUMN AND BEAM CONNECTION

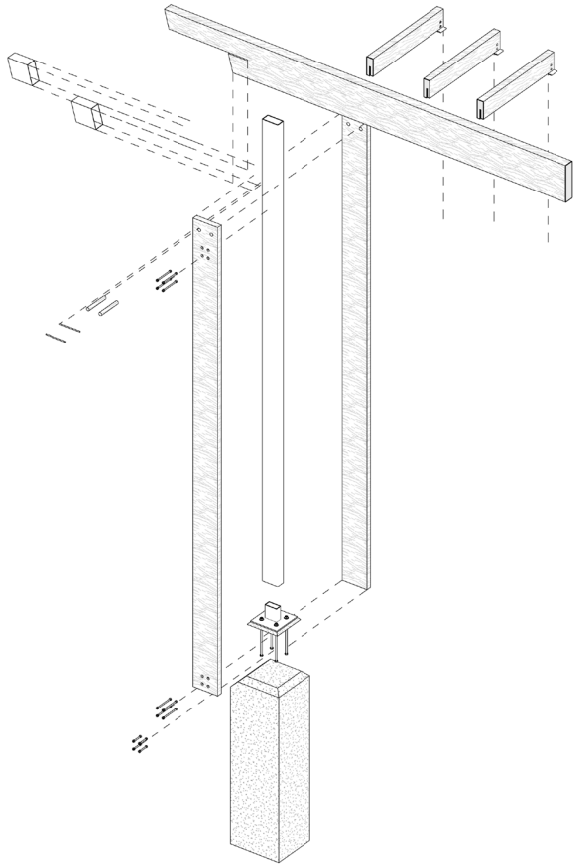
At the greenhouse, the concept of reinsertion is implemented in the way that the laminated saligna timber beams are inserted in between two saligna timber columns. Each beam is then fixed in position by means of two timber dowels inserted through the columns and the beam and kept in place by means of brass circular rounds. The ends of the beam, which are cut to the desired profile, are protected from the elements by means of two purpose-made copper cappings placed over them and fixed in position with brass wood screws. The structural integrity of the columns are increased by using a steel rectangular hollow section inserted in between the two columns and fixed to them with galvanized steel M10 machine bolts. The steel hollow section is then slotted over a smaller steel hollow section welded to the column base plate.

01_MATERIALITY



7.73 _ Detail 06 Green column and beam connection showing the materiality (Author: 2014).

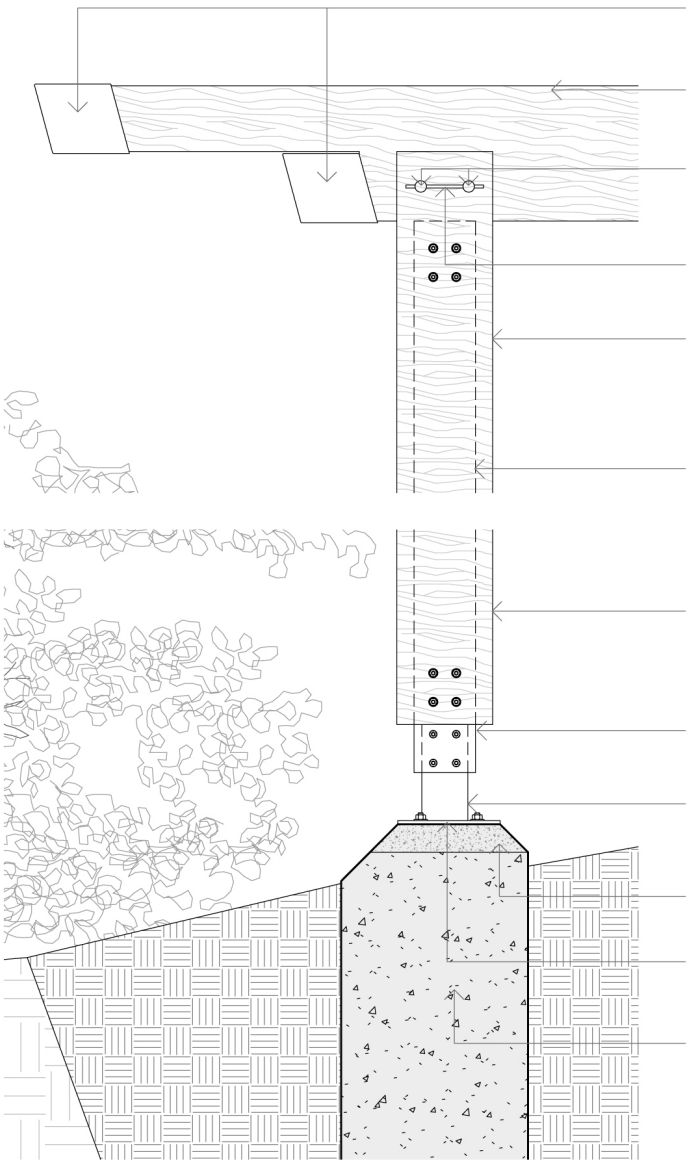
02_CONNECTIONS



7.74 _ Detail 06 Green column and beam connection showing the connections (Author: 2014).

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DETAIL 06/ GREENHOUSE COLUMN AND BEAM CONNECTION



7.75 _ Detail 6 of the greenhouse column and beam connection showing specifications (Author: 2014).

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DETAIL 07/ GREENHOUSE THRESHOLD AND ROOF DETAIL

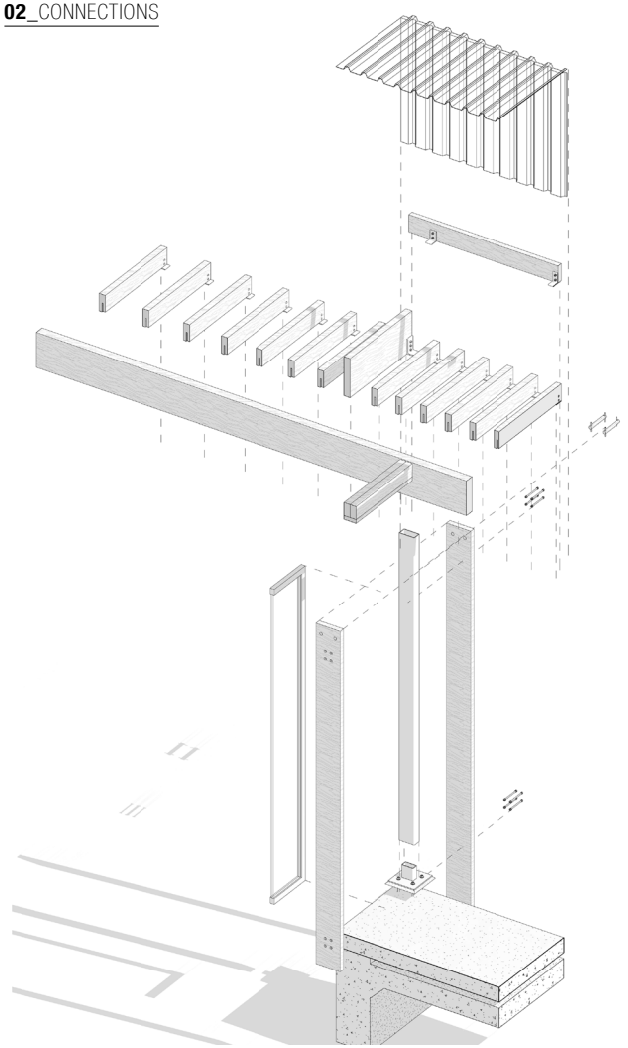
The saligna timber louvers of the greenhouse roof are fixed to the laminated saligna timber beam by means of a concealed fixing method. This is achieved by cutting a groove into the louvers which are then inserted over a steel angle screwed to the laminated saligna beam. Every aspect of the detailing is therefore realized through an expression of the tectonic theme of insertion.

01_MATERIALITY



7.76 _ Detail 07 Greenhouse threshold and roof detail showing the materiality (Author: 2014).

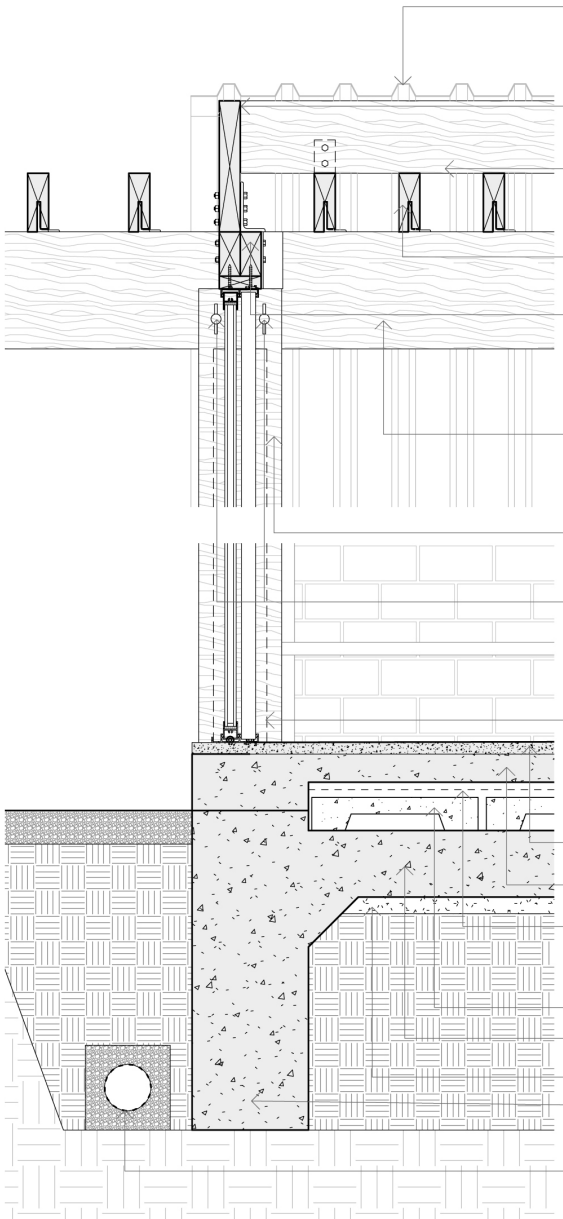
02_CONNECTIONS



7.77 _ Detail 07 Greenhouse threshold and roof detail showing the materiality (Author: 2014).

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DETAIL 07/ GREENHOUSE THRESHOLD AND ROOF DETAIL



Modek Corrugated CGI 10.5-76 profile, polycarbonate translucent sheeting 1,25mm thick, fastened through each crown of the profile to 50mm thick saligna battens @ 1200mm centers and side stitched to adjacent sheet not exceeding 400mm with minimum 250mm sealed end laps.

63 x 396mm Laminated saligna beam bolted to 150 x 75 x 10mm Hot rolled mild steel unequal leg angle and screwed to 352 x 88mm Laminated saligna beam

50mm thick saligna battens centers decreasing in height to allow for a min roof slope of 5 degree slotted into 90 x 65 x 6mm Hot rolled mild steel unequal leg angles screwed to 63 x 176mm Saligna joists @ 1200mm centers. Finished with two coats of Woodoc 35 Exterior Polywax Sealer

63 x 176mm Saligna joists slotted over 90 x 65 x 6mm Hot rolled mild steel unequal leg angle and screwed to 352 x 88mm Laminated saligna beam. Finished with two coats of Woodoc 35 Exterior Polywax Sealer

133 x 63mm Saligna beams bolted to 90 x 65 x 6mm Hot rolled mild steel unequal leg angle screwed to 352 x 88mm Laminated saligna beam

352 x 88mm Laminated saligna beam slotted inbetween two 250 x 50mm Saligna timber columns and fixed in place with 30mm dia. timber dowel. Finished with two coats of Woodoc 35 Exterior Polywax Sealer

250 x 50mm Saligna timber columns bolted to 160 x 80 x 5mm Cold formed Galvanized steel rectangular hollow section with M10 machine bolts

250 x 50mm Saligna timber columns bolted to 160 x 80 x 5mm Cold formed Galvanized steel rectangular hollow section with M10 machine bolts

160 x 80 x 5mm Cold formed Galvanized steel rectangular hollow section slotted over 120 x 60 x 5mm Cold formed Galvanized steel rectangular hollow section and fixed in place with M10 machine bolts

50mm screed cast insitu with min. 1:100 fall towards exterior

85mm concrete screed with steel mesh reinforcing

Gundle USB Green 250um damp proof membrane under concrete surface bed to SABS mark 952-1985 type C lad with minimum 150 overlaps and sealed with Gunlap pressure sensitive tape

500 x 500 x 125 pre-cast concrete drainage tiles

200mm Reinforced concrete solid slab downstand beam foundation to engineers specifications

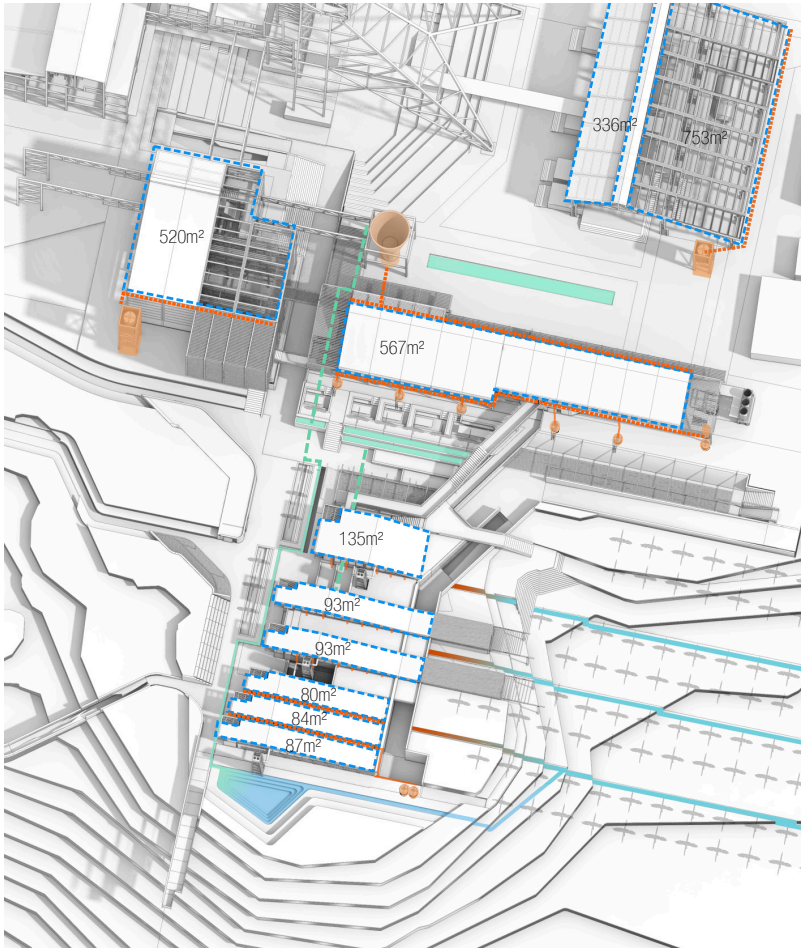
50mm Sand bedding layer

Reinforced concrete solid slab downstand beam to engineers specifications

110mm dia. Porous geopipe laid into smooth pebble bed with max 25mm dia. pebbles wrapped in 2 layers of polyester geotextile to prevent clogging of geopipe by kimberlite tailings

7.78 _ Detail 7 of the greenhouse threshold and roof detail showing specifications (Author: 2014).

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7.79_ Diagram showing the water management strategy and the rainwater harvested each month (Author: 2014).

LEGEND:

- ROOF SURFACES UTILIZED FOR HARVESTING RAINWATER
- FLOW OF RAINWATER TOWARDS STORAGE
- GREY WATER
- PURIFIED WATER UTILIZED FOR IRRIGATION OF ORCHARDS
- RAINWATER STORAGE TANKS
- ACIDIC WATER NEUTRALIZED BY USING LIME STONE AS A BASE

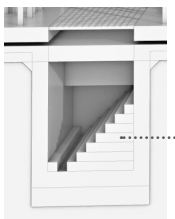
MONTH:	RAINFALL (mm):	HARVEST (90%):
JANUARY	136	2748 x 0,9 x 136mm= 336355,2 L
FEBRUARY	75	2748 x 0,9 x 75mm= 185490 L
MARCH	82	2748 x 0,9 x 82mm= 202802,4 L
APRIL	51	2748 x 0,9 x 51mm= 126133,2 L
MAY	13	2748 x 0,9 x 13mm= 32151,6 L
JUNE	7	2748 x 0,9 x 7mm= 17312,4 L
JULY	3	2748 x 0,9 x 3mm= 7419,6 L
AUGUST	6	2748 x 0,9 x 6mm= 14839,2 L
SEPTEMBER	22	2748 x 0,9 x 51mm= 54410,4 L
OCTOBER	71	2748 x 0,9 x 51mm= 175597,2 L
NOVEMBER	98	2748 x 0,9 x 51mm= 242373,6 L
DECEMBER	110	2748 x 0,9 x 51mm= 272052 L

REGENERATIVE SYSTEMS/ INTRODUCTION:

In correlation with the intention of the dissertation – to develop a new approach to industry at the mine which would regenerate the scarred environment and establish a new mutualistic relationship with the landscape – the approach to sustainable systems is based on the principle of regeneration. The destructive nature of the historical relationship between the mine and the landscape is inverted by the proposed architecture through a series of systems employed at the essential oil extraction and cider-making facilities. These systems feed back into the landscape, providing it with new forms of resources which contribute to remediating the scarred environment back to a healthy and sustainable ecosystem. The architecture thus becomes a regenerative rehabilitation device which facilitates the remediation of the damaged environment through the new industry which gives back to the landscape. This is achieved through interrelated regenerative systems which incorporate strategies of water harvesting and purification, irrigation, waste management, composting of organic by-products, ventilation, and heat transfer.

WATER MANAGEMENT STRATEGY

The water management strategy involves rainwater harvesting and storage, storm-water channeling, purification of runoff and the neutralization of grey water and the fluid by-products of cider production. In the cider-making facility, a significant volume of fluid byproducts is created during the crushing, fermentation and maturation processes. Due to these processes and the nature of the pressed fruit juices, these fluids are slightly acidic; therefore, when these fluid byproducts mix with water during the cleaning of floors in the production areas, the resultant grey water has a lower pH value than normal and requires neutralization. This will be achieved by means of limestone blocks (see **Figure 7.80**), dry-packed in the water channels in the production spaces (see **Figure 7.79**), which function as a base to neutralize the acidic grey water. The neutralized grey water can now be directed through a sediment filter and then channeled towards the orchards for irrigation purposes. This is done by means of a series of water furrows which extends into the landscape from the cider-making facility. In this way the cider-making facility gives new resources, in the form of nutrients and water, back to the landscape through irrigation. Rainwater is harvested from all roof surfaces to be used for cleaning, staff showers, the flushing of toilets and irrigation. The total roof area of the existing industrial buildings and the proposed architecture from which rainwater is to be harvested amounts to 2748m². The projected yield for each month is shown in **Figure 7.78.**

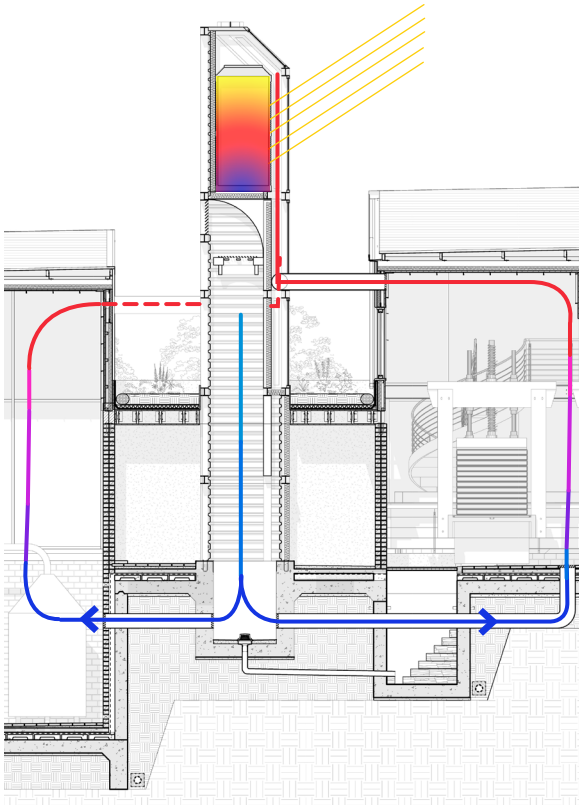


7.80 _ Water channels in the production spaces (Author: 2014).



7.81 _ Limestone blocks (Author: 2014).

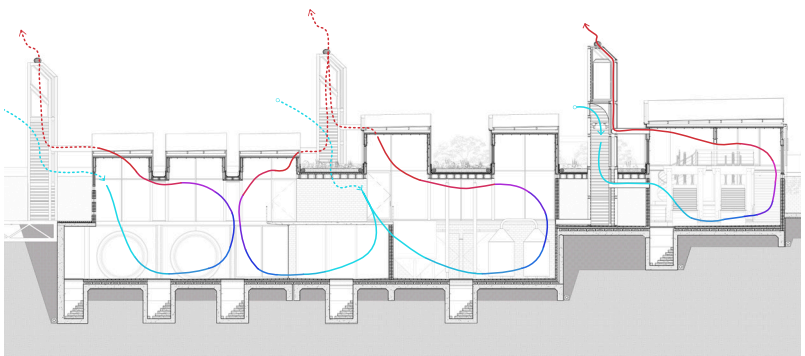
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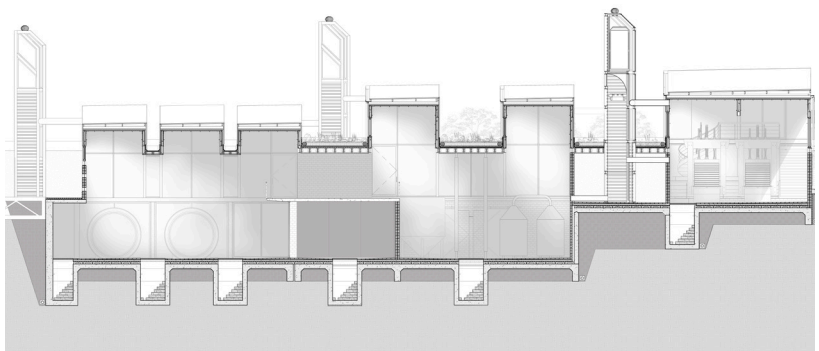
7.82 _ Showing the functioning of the trombe stack ventilation and evaporative cooling tower (Author: 2014).

REGENERATIVE SYSTEMS/ THE CIDER-MAKING FACILITY_ VENTILATION AND LIGHTING

In the fermentation and maturation spaces of the cider-making facility, a significant amount of carbon dioxide is produced when sugars are broken down by yeast during primary and malolactic fermentation. A certain amount of this carbon dioxide is retained in the cider and contributes to its carbonation, while the majority of the gas escapes the fermentation vessels and is released into the air. This creates an unhealthy internal environment and therefore sufficient ventilation is required within these spaces. To address this issue, a series of trombe stack ventilation towers utilize solar gain to draw out warm stale air and carbon dioxide released during fermentation and maturation. This passive system consists of a 100mm wide glazed cavity with thermal mass in the form of a dark-coloured uPVC water tank. The thermal mass is heated through solar radiation which in turn heats up the air in the cavity, causing the warm air to rise (see **Figure 7.81**). Known as the stack effect, it creates negative air pressure (suction) in the production spaces in order to draw out the warm air and carbon dioxide. A purpose-made roof ventilator, when activated by the wind, starts to suck out the air from the cavity to initiates the stack effect. Because water has a significant thermal capacity, the dark water tank which is heated during the day will still radiate heat at night due to the flywheel effect, enabling the stack to continue drawing out air at night. Furthermore, the tower also functions as a direct evaporative cooling tower by utilizing a low-voltage fan to draw in air which is cooled with water vapour released by a series of nozzles. The cooled fresh air gradually moves down into the tower towards its base, from where it is pumped into the various production spaces via a series of ducts (see **Figure 7.81**). A direct evaporative cooling method able to cool a greater volume of air more rapidly, as opposed to indirect evaporative cooling, can be utilized. This is due to the fact that the internal environments are already very wet from the various production processes and will therefore be unaffected by increased humidity. These ventilation towers exist as freestanding lightweight steel structures, positioned between the roofs of the different production spaces in order to be able to ventilate and cool more than one space simultaneously (see **Figure 7.82**). Due to the fact that the temperature of the cider-making facility has to be kept at between 14-18 degrees Celsius, no direct solar gain can be permitted into these spaces, as this would create a risk of overheating; therefore these spaces are only provided with small south-facing clerestory windows to allow soft indirect daylight to enter, as shown in **Figure 7.83**.



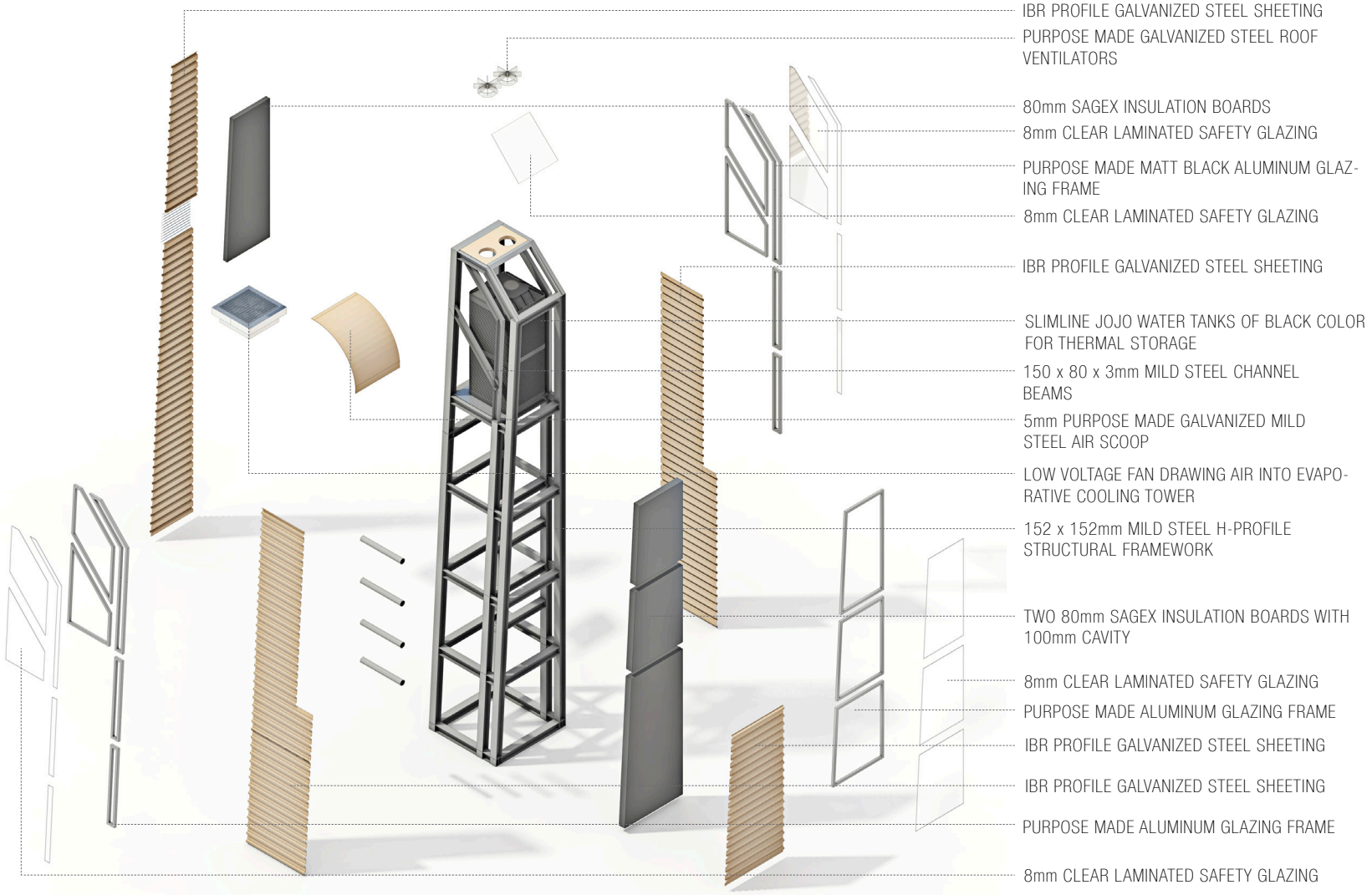
7.83 _ Showing the flow of air and ventilation of the production spaces through the trombe stack ventilation system (Author: 2014).



7.84 _ Showing the natural daylight illumination of production spaces within the cider-making facility (Author: 2014).

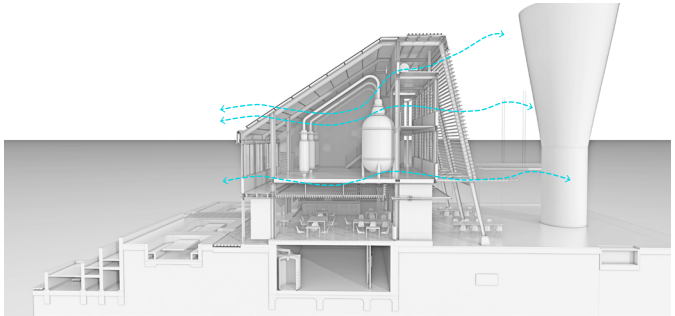
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EXPLODED SECTION /
TROMBE STACK VENTILATION AND EVAPORATIVE COOLING TOWER

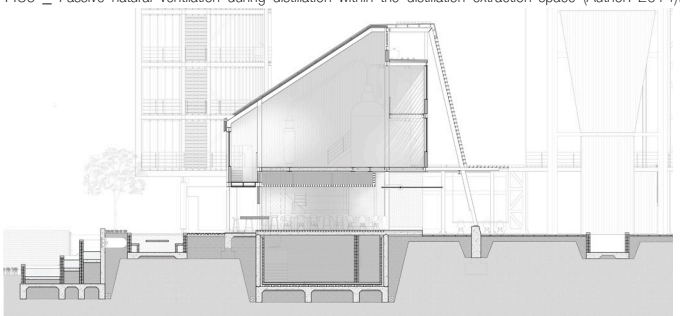


7.85 _ Construction explosion of the trombe stack ventilation and evaporative cooling tower (Author: 2014).

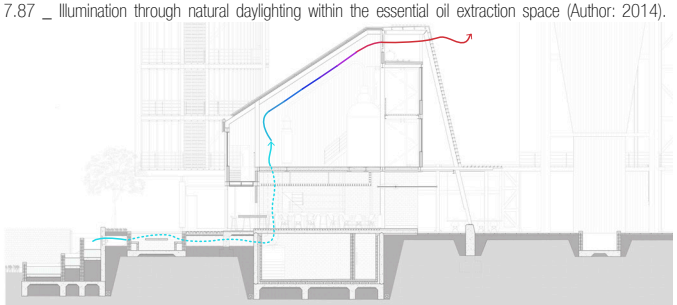
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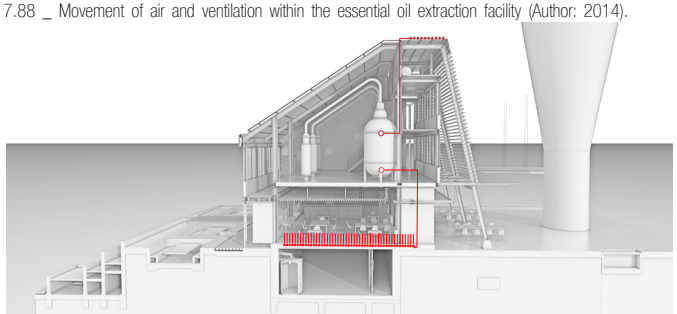
7.86 _ Passive natural ventilation during distillation within the distillation extraction space (Author: 2014).



7.87 _ Illumination through natural daylighting within the essential oil extraction space (Author: 2014).



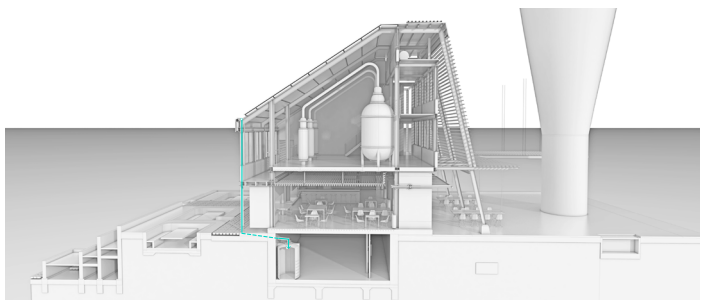
7.88 _ Movement of air and ventilation within the essential oil extraction facility (Author: 2014).



7.89 _ Transfer of heat for underfloor heating of the restaurant and bar during Winter (Author: 2014).

REGENERATIVE SYSTEMS/ THE CIDER-MAKING FACILITY_ DAYLIGHTING, VENTILATION, HEAT TRANSFER AND WATER HARVESTING AND WASTE MANAGEMENT.

Within the essential oil extraction facility, a significant amount of heat and steam is generated during distillation and extraction. In response to this issue large, open able double-glazed windows placed in the northern and southern facades allow the production spaces to completely open up and be naturally ventilated, removing steam and preventing overheating (see **Figure 7.85**). The northern facade is provided with a louvered screen as an environmental control device which prevents overheating by blocking direct solar radiation. The southern fenestration allows soft, indirect light to enter the extraction spaces and provides a view towards the landscape along the experiential public route (**Figure 7.86**). Fresh air that has been evaporatively cooled over water channels is drawn into the basement by means of a low-voltage fan and ventilation ducts (**Figure 7.87**). Here the air is cooled further and then pumped up towards the extraction spaces above. A direct-flow evacuated tube solar water heater located on the roof of the distillation extraction space, shown in **Figure 7.88**, is utilized to pre-heat the water used for steam distillation, significantly reducing the required heat input of the distillation process. Furthermore, during winter the excess heated water generated during distillation is utilized to heat the cider tasting space and restaurant. This is achieved by means of uPVC pipes cast into a 100mm screed layer that then conveys the heated water as an underfloor heating system. Rainwater is harvested from the roof of the essential oil extraction facility and stored in the basement, as shown in **Figure 7.89**. This rainwater is used for hydroponic irrigation in the greenhouses, for cleaning the production spaces, for flushing and showering in the staff bathrooms, and for irrigating the orchards. The organic waste in the form of spent essential oil crops, a byproduct of essential oil extraction, is processed in composting bins to produce nutrient-rich fertilizer for use in the surrounding landscape and the orchards. The essential oil extraction facility thus becomes a device that facilitates the remediation and rehabilitation of the scarred landscape through a series of interconnected systems that feed resources back into the scarred environment.

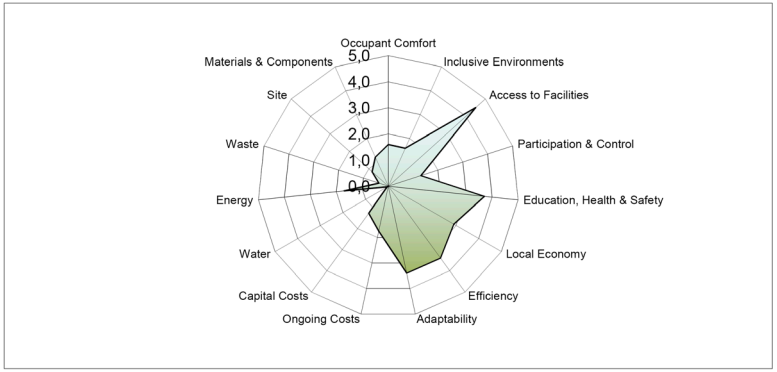


7.90 _ Harvesting and storage of rainwater in the essential oil extraction facility (Author: 2014).

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01_ SBAT ANALYSIS BEFORE INTERVENTION

PROJECT		ASSESSMENT	
Project title:	Cider-making facility and essential oil extraction	Date:	20-Oct-14
Location:	Cullinan, Gauteng, South-Africa	Undertaken by:	Walter Raubenheimer
Interior type (specify):	Industrial Production, public space, retail	Company / organisation:	Student
Internal area (m2):	2259	Telephone	825516507
Number of users:	40	Email:	walterraubenheimer@gmail.com
Building life cycle stage (specify):	Design		

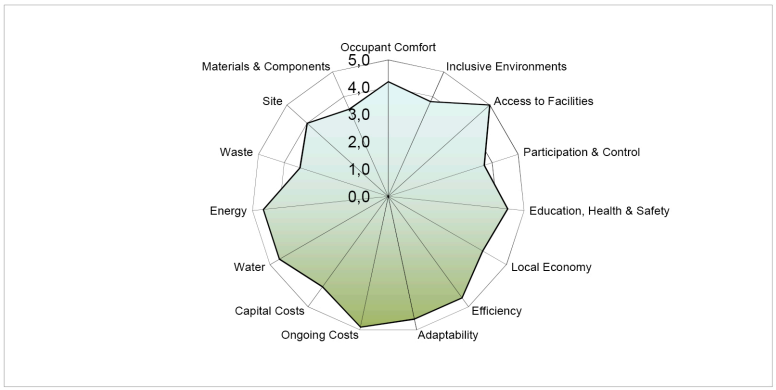


Social	2,5	Economic	2,5	Environmental	0,8

Overall	2,0

02_ SBAT ANALYSIS AFTER INTERVENTION

PROJECT		ASSESSMENT	
Project title:	Cider-making facility and essential oil extraction	Date:	20-Oct-14
Location:	Cullinan, Gauteng, South-Africa	Undertaken by:	Walter Raubenheimer
Interior type (specify):	Industrial Production, public space, retail	Company / organisation:	Student
Internal area (m2):	2259	Telephone	-
Number of users:	40	Email:	walterraubenheimer@gmail.com
Building life cycle stage (specify):	Design		



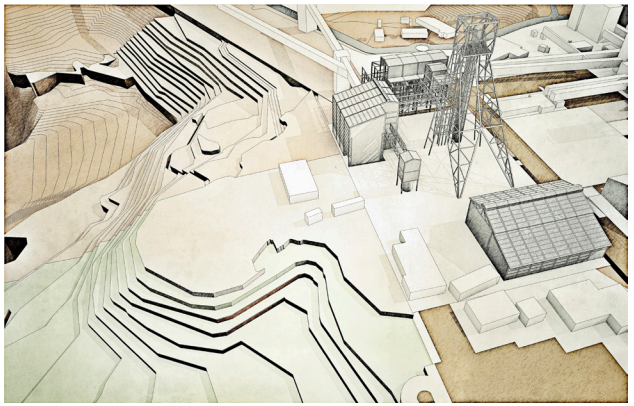
Social	4,2	Economic	4,4	Environmental	4,0

Overall	4,2

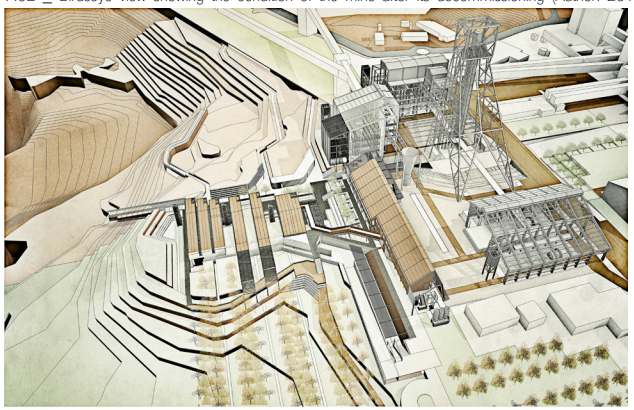
7.91 _ Comparison of the SBA analysis before and after the implementation of the proposed intervention (Author: 2014).

SBAT ANALYSIS/ A COMPARATIVE STUDY

To compare the effect of the proposed architectural intervention on the site in terms of sustainability the SBAT analysis tool was utilized. The diagrams in Figure 7.74 shows this comparison. It is apparent that numerous social, economic and environmental issues have been improved by the proposed intervention. The areas that show the most significant improvement are ongoing costs, capital costs, energy, waste, materials and components, occupant comfort, inclusive environments and Participation and control. Mayor improvements were achieved by re-using salvaged and reclaimed structural components and raw material available on site for the construction of the proposed building. Appropriate orientation, trombe stack ventilation and evaporative cooling, natural ventilation and environmental control, passive water heating and effective water and waste management systems are the factors that contributed most to attaining an improved SBAT rating



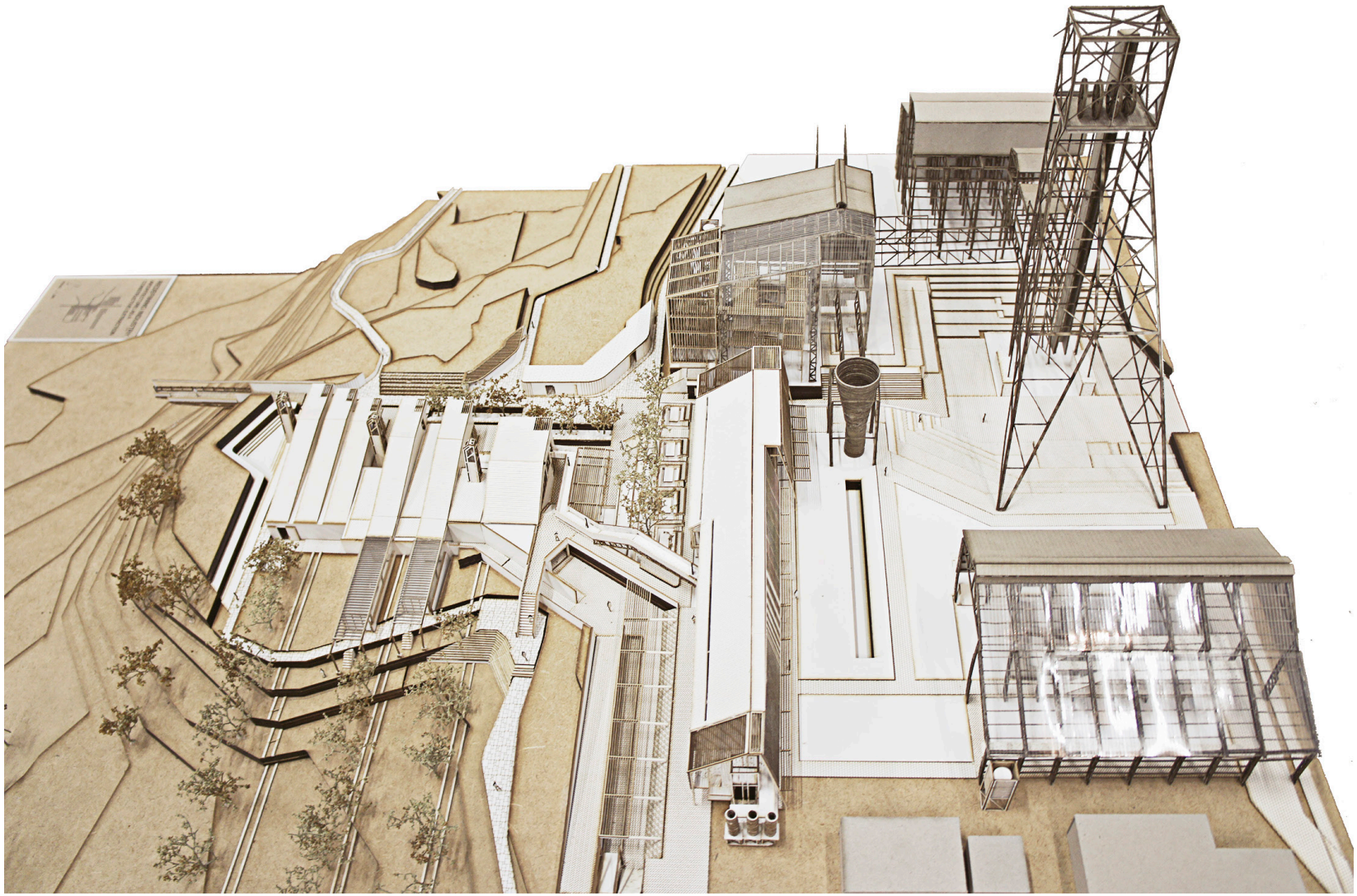
7.92 _ Birdseye view showing the condition of the mine after its decommissioning (Author: 2014).



7.93 _ Birdseye view showing the implementation of the proposed intervention (Author: 2014).

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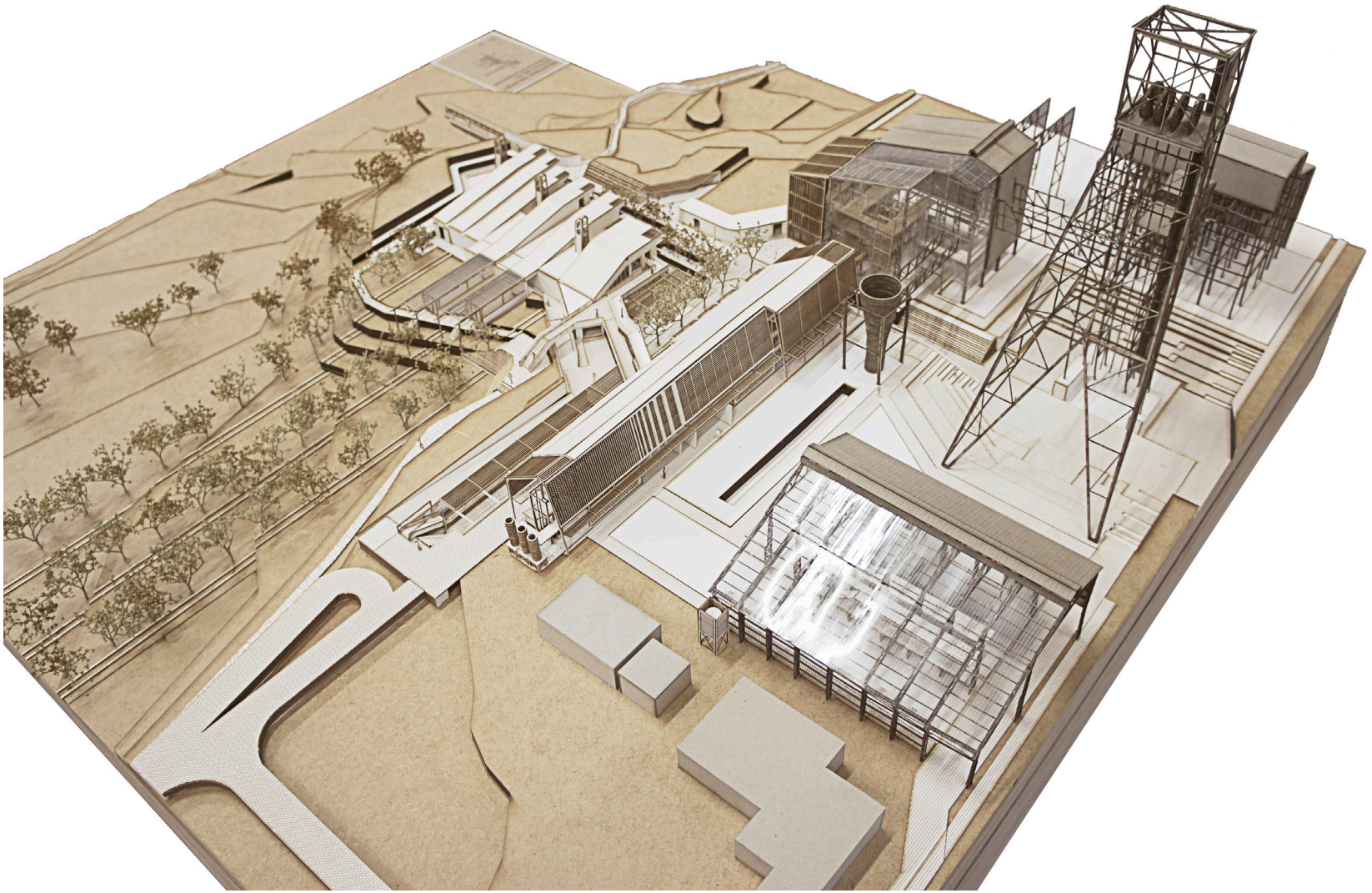
FINAL DESIGN/ MODEL



7.94 _ Final design model (Author: 2014).

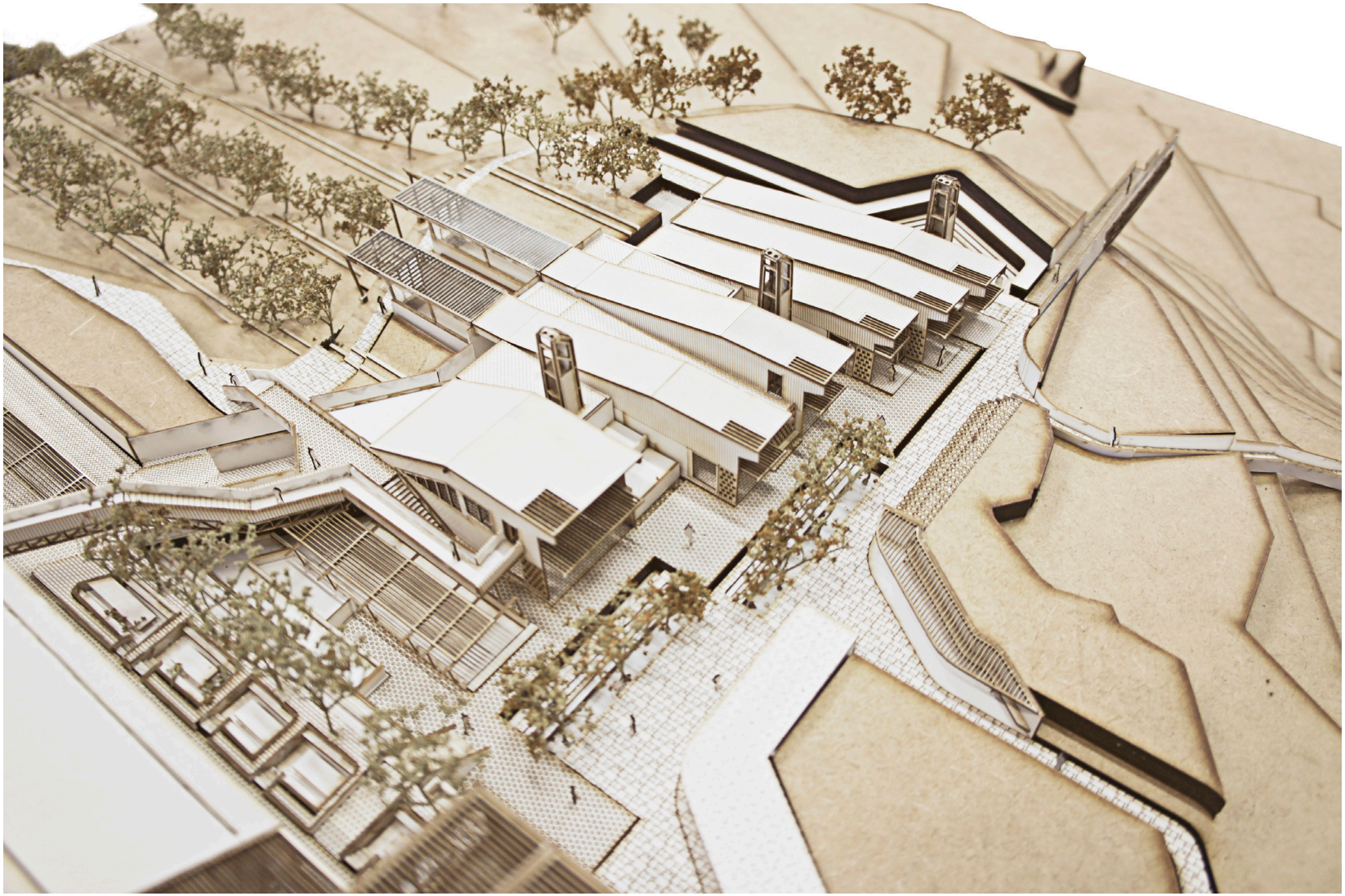
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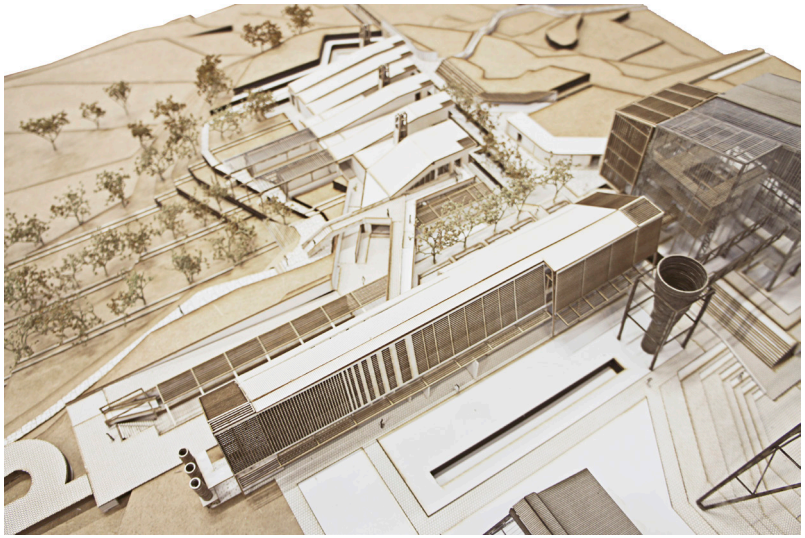
7.95 _ Final design model (Author: 2014).

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7.96 _ Final design model (Author: 2014).

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7.97 _ Final design model (Author: 2014).



7.98 _ Final design model (Author: 2014).

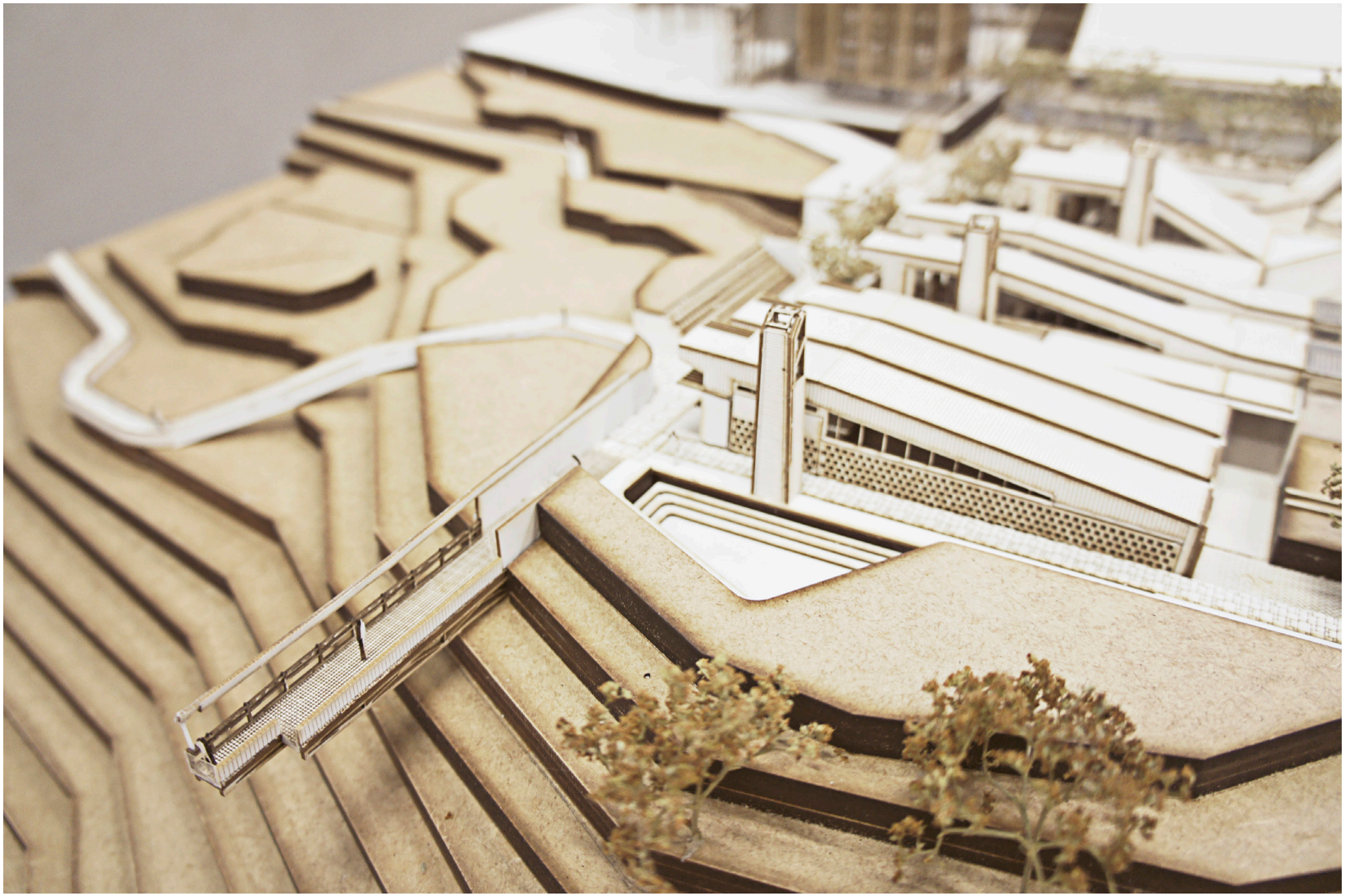


7.99 _ Final design model (Author: 2014).



7.100 _ Final design model (Author: 2014).

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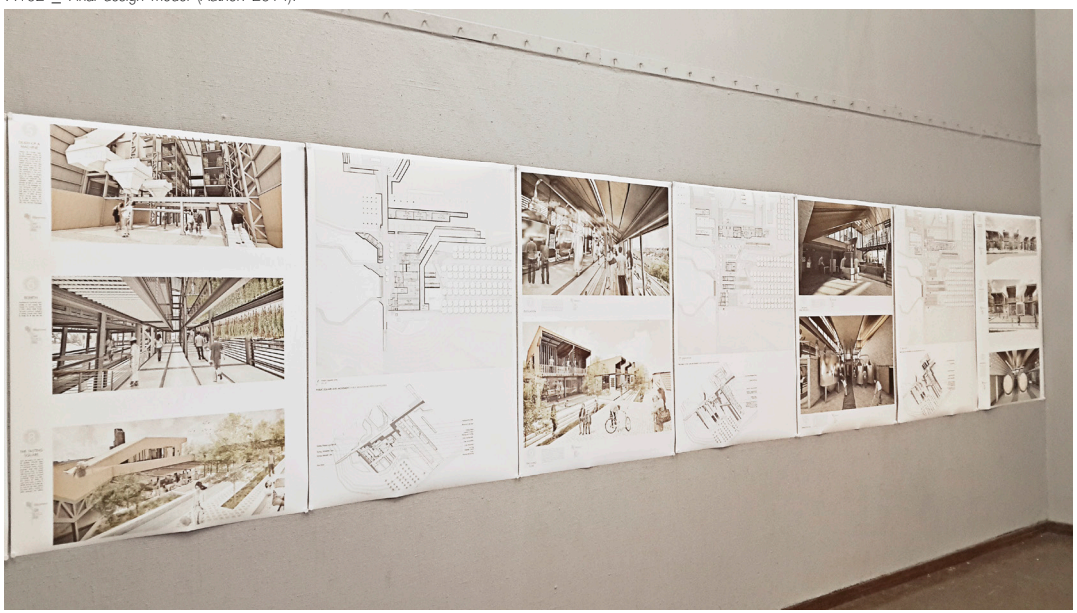
7.101 _ Final design model (Author: 2014).

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FINAL PRESENTATION/ 28 NOVEMBER



7.102 _ Final design model (Author: 2014).



7.103 _ Final design model (Author: 2014).

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FINAL PRESENTATION/ 28 NOVEMBER



7.104 _ Final design model (Author: 2014).



7.105 _ Final design model (Author: 2014).

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CONCLUSION/ REDEFINING INDUSTRY_
ARCHITECTURE AS A CONSTRUCTIVE EXTRACTION

The intention of this dissertation was to question the current rehabilitation strategy developed by authorities for the Cullinan Diamond Mine, which would result in a loss of authenticity, heritage value and a connection with place. This led to an investigation into the fate of the industrial heritage site and investigated the role that architectural design can play as an alternative solution to increase resilience and regenerate the scarred landscape.

By applying regenerative principles, inherent place-bound potential was discovered and harnessed to inform a new approach to rehabilitation through architecture. This led to the design of a facility for essential oil extraction and cider-making as interconnected industries, which tap into existing resources of the decommissioned industrial context to provide social and economic incentives for rehabilitation. By drawing on the principles, materiality and detailing of the existing industrial archetype, a new conceptual approach to the design and technical resolution of industrial architecture was developed. This approach inverts the destructive relationship between the historical industry and the landscape by establishing a new co-evolving, mutualistic relationship with the scarred environment. The proposed architecture contributes to the remediation of this environment by employing a series of systems that feed back into it, providing it with new forms of resources and nutrients. Additionally, by utilizing raw materials sourced from the site and re-using salvaged structural components, the building becomes part of the environment it regenerates. Functioning as a regenerative rehabilitation device, the architecture facilitates the remediation of the post-industrial scarred environment by giving back to its surroundings rather than merely disrupting nature for economic gain. The concept of architecture as a constructive extraction postulates that, by adding another layer to the post-industrial environment and transforming the scarred landscape into a productive landscape, as opposed to a recreated natural landscape, future growth can be facilitated without losing the sense of place. The proposed architecture commemorates the relationship between the industrial heritage and the scarred landscape by re-establishing a connection between the mine and the open-pit excavation. The redundant industrial heritage buildings and structures are revived through adaptive re-use and provided with new significance and meaning.

The existing industrial typology at the mine, being primarily informed by functional requirements, disregarded human experience and the making of public space. This resulted in a limited and restricted spatial and experiential environment, a condition which would be exacerbated by the decommissioning of the mine. The proposed architecture redefines the industrial typology by providing for a diversity of public experiences as opposed to merely responding to functional requirements. Through architecture, an experiential promenade is created within the scarred environment, allowing for a multiplicity of sensory and spatial experiences. This diversity contributes to the resilience of the site, is conducive to the formation of new memories, re-establishes a connection with place, and encourages a meaningful reflection on the past. Where the layers of experience and production overlap, potential for programmatic synergy can be identified. Possibilities of cross-influence between the public and industrial realms create potential for a new experiential public interface which would encourage an appreciation of and interaction with the industrial heritage and the proposed industry.

In considering the principles of regenerative design, the question arises as to how the proposed architecture will address its own inevitable decommissioning when the new industries become redundant. The nature of the design, through its use of bolted connections, long-span trusses allowing for large unobstructed floor areas, modules of construction with lightweight infill, and structure allowing for disassembly, provides exciting opportunities for future reconfiguration, adaption and re-use. The design serves as a prototype for dealing with decommissioned mines in the South-African context. It illustrates how these can be revived through architecture which transforms the mono-functional industrial archetype into a multi-functional regenerative mechanism, without degrading the industrial heritage.

The industrial landscape is an outstanding historical resource to be re-used, regenerating communities, offering real richness and opportunity, reinforcing cultural identity and creating new commercial prospects (Cossons, 2012:14).

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