
Reinventing Infrastructure

An Urban Arena for Cultural Exchange:

Amplifying the significance of the disenfranchised Apies River island as 'other-place' between city and suburb

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REINVENTING INFRASTRUCTURE

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Amplifying the significance of the disenfranchised Apies River island
as 'other-place' between city and suburb

Keywords: Public infrastructure, recreational urban space, Apies River

Address: 451 Church Street, Arcadia, Pretoria
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Multi-functional Programme: Public retail, social and recreational facilities and landscape,
workshop and exhibition space, auditorium and meeting spaces

Research Field: Public Infrastructure, Environment Potential, Heritage and Cultural Landscapes

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My parents and siblings

Abstract

The potential of the Apies River Corridor, and the identified site's relegation to the engineering demands of modernisation, has resulted in layers of water, built fabric, transport and energy infrastructure that presently dissect the site into rigidly controlled, isolated functions. This has consequently led to the loss of the Apies River's recreational and natural presence within the city. Its ecological potential as resource, as well as its enigmatic and symbolic existence, has been straightjacketed into a linear concrete entity. Its historical significance in the establishment and development of the city, as well as its significance as recreational identity, has been rendered anonymous. Fragmented enclaves (deadlock urban situations) have restricted the potential of underutilised, surplus public spaces.

The theoretical premise of this dissertation asserts that the great divide between nature and culture of the modern paradigm, and the consequential development of industrialisation and urbanisation, controlled our cities' natural resources in independent networks of infrastructural systems, to the control, convenience and exploitation of our cultural practices. Implemented as vehicles for political, social and economic agendas, the current isolated implementation of our urban infrastructure are spatially fragmenting the public realm.

The site chosen for the project has been identified as a collection of fragmented surplus sites adrift between the infrastructural edges of the historic Ceremonial Boulevard know as Stanza Bopape Street (formerly Church Street), and the Apies River Corridor; two significant infrastructural entities in the city of Pretoria.

A reinterpretation of our development processes is required, that acknowledges non-human natural systems as agents and acknowledges the constraints of our cultural practices.¹ By reimagining existing infrastructure as part of the production of form and space, marginalised urban voids can be regained for innovative design interventions, alternative occupation, and public appropriation. The potential of such a reinvention lies in public space that capitalises on the spatial, material and socio-economic possibilities of infrastructure to increase the area's ecological contribution, and amplify its historical significance through establishing a relationship between Stan Street, the Apies River, the proposed interventions and historical remnants, towards reinstating an enigmatic and recreational experience as well as ecological awareness beyond its infrastructural use.

1. A general theory in the realm of environmental ethics, known as the last man argument was constructed by Richard Sylvan (before 1983). This thought experiment aims to illustrate that the dominant principles of the Western ethical tradition (which Sylvan calls a "super ethic"), as incapable of providing a satisfactory foundation for an environmental ethic. The last man thought experiment argues that because there are no other human considerations, the chauvinistic freedom principle therefore hold no grounds for moral disapproval of his actions. However, to an environmentally progressive ethics, the actions of the last man are morally appalling. The influential instinctual impact of this thought experiment exposes a prevalent, however not universal, biophilia that reinforces an appreciation that the exhaustion of our natural resources and biodiversity deprives us not only from the resources but diminishes the life to which many of us aspire. (Grey 2009: 40-41)

Opsomming

Die teoretiese uitgangspunt van hierdie verhandeling konstateer dat die ruimtelike fragmentasie van ons huidige stedelike toestand grotendeels beïnvloed word deur die skeiding van natuur en kultuur in die moderne paradigma, asook gevolglik die ontwikkeling van industrialisering en verstedeliking wat natuurlike hulpbronne in geïsoleerde netwerke van infrastrukturele stelsels beheer, as instrumente vir politiese en sosio-ekonomiese agendas.

Die potensiaal van die Apiesrivier-korridor en die geïdentifiseerde terrein word tans beperk tot stelsels / sisteme vir water, geboue, vervoer en energie – infrastruktuur wat streng beheer uitoefen oor prosesse en hulpbronne in geïsoleerde netwerke, as gevolg van die feit dat die rivier gereleer is om aan die eise van modernisering en stedelike ontwikkeling te voldoen. Gevolglik het dit gelei tot die verlies van die Apiesrivier se natuurlike teenwoordigheid in die stad. Die ekologiese potensiaal van die rivier as hulpbron, asook sy enigmatiese en simboliese bestaan word beperk tot 'n lineêre beton entiteit. Die historiese betekenis daarvan vir die vestiging en ontwikkeling van die stad, asook die betekenis as ontspanningsidentiteit het anoniem geraak. Die ontwikkelingspotensiaal van die rivier en aangrensende terreine word tans onderbenut as gevolg van hierdie gefragmenteerde stedelike toestand.

Die voorgestelde terrein is geïdentifiseer as 'n versameling gefragmenteerde aangrensende terreine, ingeperk deur die infrastrukturele grense van die historiese Seremoniële Boulevard , naamlik Stanza Bopapestraat (voorheen Kerkstraat) en die Apiesrivier stormwaterkanaal; twee belangrike infrastrukturele entiteite in die stad van Pretoria.

'n Herinterpretasie, wat nie-menslike natuurlike stelsels as agente erken, asook bewus is van die beperkings van ons kulturele praktyke, word vereis. Deur bestaande infrastruktuur geïntegreerd te herontwikkel as deel van toekomstige projekte, met 'n fokus op die skepping van vorm en ruimte, bied geleenthede vir innoverende ontwerpings, alternatiewe gebruike, en openbare herbenutting. Die potensiaal van hierdie herbenutting word omsluit in die vermoë van openbare ruimtes se om by te dra tot die stimulering van die ruimtelike, materiële, en sosio-ekonomiese moontlikhede van infrastruktuur om die ekologiese bydrae van die gebied te verhoog en sy historiese betekenis te versterk deur 'n nuwe verwantskap tussen Kerkstraat, die Apiesrivier, die voorgestelde argitektoniese ingrypings en historiese oorblyfsels te skep om uiteindelik 'n enigmatiese ervaring asook ekologiese bewustheid bo en behalwe die rivier infrastrukturele gebruik te herstel.

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Preface

The author holds the belief that architects ought to commence research and projects on the scale of the city. "...[A]rchitecture and designed landscapes serve as grand mnemonic devices that record and transmit vital aspects of culture and history" (Treib 2009:i). An underlying framework that supports the exchange between the urban fabric, cultivated landscapes and cultural transformations is defined through the infrastructure of our cities. Including everything from stormwater conveyance systems to railway and vehicular networks, sanitation services and information networks, as a few of the numerous examples, infrastructure is omnipresent and facilitates all human activities.

Apart from the magnitude of the impact of infrastructure on the built environment through its scale, its ability to provide a cultural reference point in cities through its potential to produce a diverse programmatic and socio-cultural response to public space, as well as its inherent connective and enabling agenda, reinforces the view of infrastructure as a critical area of investigation with particular relevance for the architectural profession.

The present condition of existing infrastructure as isolated layers, and its sectional potential involving structure and space, incentivises an architectural investigation that expresses a concern for design professionals to play an active role in the development and implementation of infrastructure in the public realm. This investigation therefore aims to mitigate the negative spatial and socio-economic impacts of unintegrated infrastructural implementations, towards encouraging an emphasis on infrastructure with a deliberate agenda of producing positive public space that allows for a multiplicity of socio-economic opportunities and public appropriations of the urban realm.

01

CHAPTER ONE

INTRODUCTION

Main Observation

Problem Statement

Introduction to the Urban Framework

Urban Vision

The Apies River - Urban Issues and Opportunities

Identifying the Site

Programmatic Intentions

Architectural Hypothesis

Research Questions

Design Informants

Methodology

1.1
Main Observation

The integrity of architecture's apparent stability is rooted in a collection of interdependent natural-cultural forces, constantly generating themselves through processes of transformation. However, the strain of these forces reveals a tense environment and a humanity with restricted control of nature, and of its own transformation. Change becomes integrated and consequential in these interdependent suspended fields, rendering the idea of pure autonomy obsolete (Woods 2009).

The theoretical premise of this dissertation argues that the spatially fragmented public realm of the present condition of our cities is one of the resultant factors of the great divide between nature and culture of the modern paradigm and of the development of industrialisation and urbanisation controlling natural resources in isolated networks of infrastructural systems as vehicles for political, social and economic agendas.

1.2
Problem Statement

Infrastructural developments have consequently rendered the presence of nature in cities anonymous, have disenfranchised its potential opportunities to serve as resource and amenity with enigmatic characteristics from society and the city, and have inevitably expedited the depletion of its availability.

A reinterpretation of our development processes is required that acknowledges non-human natural systems as agents and also acknowledges the constraints of human practices, in order to move towards an ecosystemic approach.

With new opportunities, new challenges and a vulnerable landscape to cultivate and preserve; architecture of the near future and its urban consequences ought to be cognisant of historical potentials and failures, yet, their essence should be as different as that of the century before (Holl 1996).



Figure 1.1 Crossing over the Apies River at Arcadia drift. (Hilton T)



Figure 1.2 Bon Accord Dam as recreational entity to the Apies River Corridor. (Hilton T)

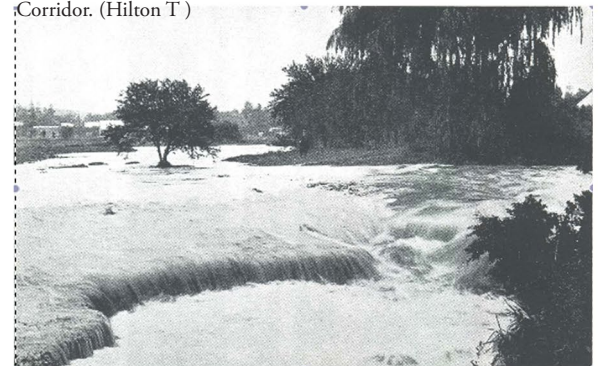


Figure 1.3: Flooding resulting in the cannalisation of the Apies River. (Barnard and van Niekerk 2013)



Figure 1.4: Present condition of the cannalised Apies River. Photograph by author

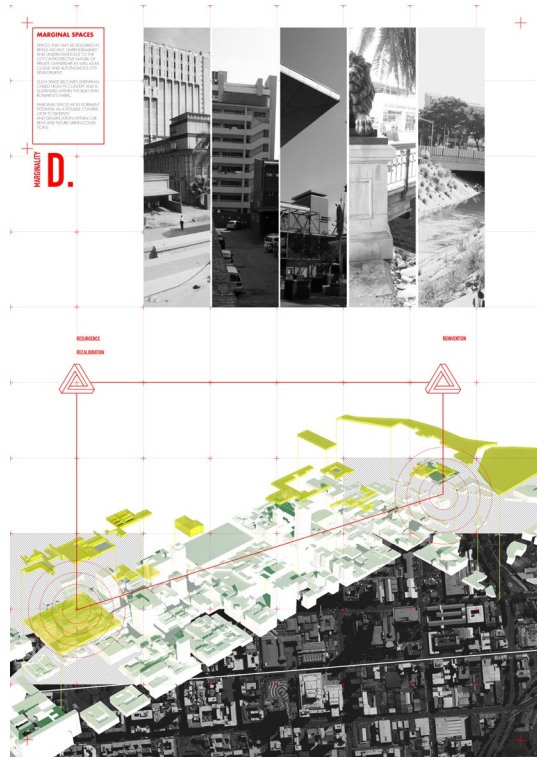


Figure 1.5 Urban mapping investigation illustrating the marginal spaces identified within the area of investigation, as well as identified areas of intervention. By framework group 2015

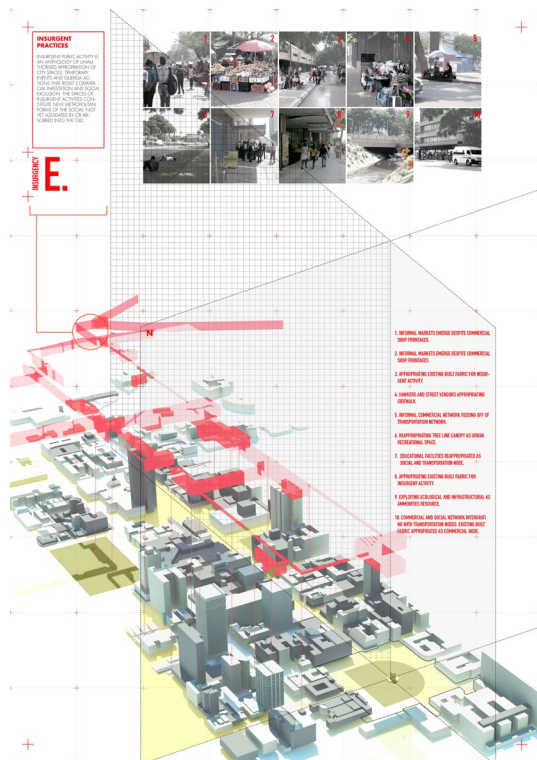


Figure 1.6 Urban mapping investigation illustrating the insurgent activities identified alongside marginal spaces within the area of investigation. By Framework group 2015

1.3

Introduction to the Urban Framework

Historically the city of Pretoria has undergone multiple layers of transformation. When viewed from above, the city appears to have been striated over time, due to the power of political, economic and infrastructural transformation. The most predominant consequences can be identified as governmental migration from the city centre; a lack of public interface and no relationship between civic spaces and proposed introspective isolated precincts; economic agendas resulting in autonomous property development; and infrastructural expansion resulting in isolated systems of networks implemented in an ad hoc way, spatially presenting an unsustainable, non-resilient and homogenous base for the future densification of the city centre.

The bureaucratically driven origination and development of Pretoria as administrative capital, as opposed to an agenda driven by resources or socio-economic considerations, has allowed the city to elude its socio-cultural responsibilities, leading to urban and social entropy in marginal public spaces. In their damaged state, they offer entirely new possibilities for first understanding the conditions constituting public space in the present state of our cities, and investigating an alternative appropriation of an architectural intervention in a place undergoing continuous transformation.

1.4

Urban Vision

The urban vision aims to create a more diverse and sustainable framework for future development strategies, such as the Re Kgabisa Inner City Development Project and the Tshwane Vision 2055: Remaking South Africa's Capital City, through addressing factors that presently lead to the marginalisation of public space within the city, by applying an architectural intervention that challenges the future perpetuation of this condition. The urban vision proposes to reimagine an underutilised network of disenfranchised spaces into a heterogeneous adaptable system that is integrated with the existing city infrastructure, rather than hierarchical interventions of architectural dominance. The city's real identity and the concerns of its lived reality need to be extracted from its undermined position and exposed to challenge and develop the residue of the city's bureaucratic ideological agendas.

1.5

The Apies River - Urban Issues and Opportunities

The Apies River corridor and the identified site have been relegated to engineering due to the demands of modernisation, resulting in layers of water, built fabric, transport and energy infrastructure that presently dissects the site into rigidly controlled, isolated functions.

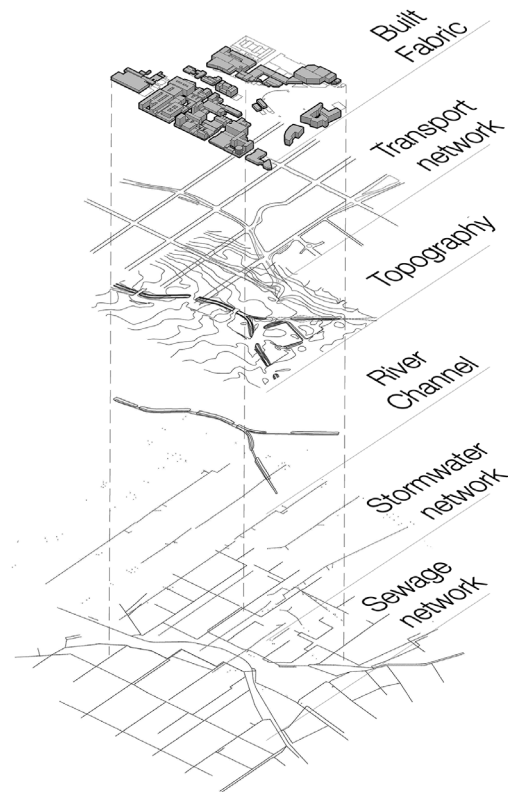
- The abovementioned has resulted in the loss of the collective presence and significance of the river within the city.
- Its ecological resources and potential as well as its enigmatic and symbolic presence have been straightjacketed into a linear concrete entity.
- Its historical significance for the establishment and development of the city, as well as its significance as recreational identity, has been rendered anonymous.
- Fragmented enclaves and impasses (deadlock urban situations) have diminished the potential of public spaces.



1.6

Identifying the site

The chosen site has been identified as a collection of fragmented surplus sites adrift between the infrastructural edges of Nelson Mandela Drive and the Apies River corridor. The site is hinged on its northern boundary to the historical Ceremonial Boulevard know as Stanza Bopape Street (old Church Street), as potential inception point of a collection of positive opportunities to be the extracted and amplified between the city and the surrounding suburbs.



1.7

Proposed Programmatic Intentions

The programme as cultural urban arena becomes an adaptive, dynamic infrastructural device for a performative public spectacle, established on the Ceremonial Boulevard between Church Square and the Union Buildings. This intensified public realm would consist of a decentralised urban stormwater filtration system, and a cultural memory park with social, economic and recreational facilities bordering the inner city and its surrounding suburbs.

The proposed recreational and socio-economic appropriations represent possible scenarios of the animated infrastructure. Thus the programmatic response requires an alternative reimagination of a hybrid typology that addresses the need for inter-operability and adaptable appropriations that would encourage urban scenarios of social and economic engagement at different time cycles, continuously activating the precinct and enhancing a symbiotic relationship towards resilient urbanisation.

1.8

Architectural Hypothesis

Regardless of the multiplication of artificial environments, our cultural influences cannot be removed from our interpretation of nature that establishes us as living beings. Both the cultural constructs and natural entities of cities are manifestations of the relations between natural and cultural developments over time and collectively influence a city's distinctive existence (Whiston Spirn 2002:4). Infrastructure has the potential to facilitate an integrated continuum of this nature-culture exchange between the natural systems and resources operating and shaping our artificially constructed built environments. The "final" proposal can therefore not be an individual product or intervention, but is therefore rooted in a broader spatial vision, a didactic metabolism for activating the specific condition and similar consequential conditions prevalent in the city.

1.9

Research Questions

- How can the dehumanised infrastructural complexes in the city be reinvented in a symbiotic relationship with ecological and socio-cultural existence?
- How can a newly established architectural identity through exploitation of infrastructure and resources – its scale, language, accessibility and edge conditions – establish an intangible dialogue with the polarised conditions of the city centre and residential areas?
- How can an infrastructural reinvention of an adaptable recreational and socio-economic typology, through a discharge into its context, amplify the positive opportunities and significance of the spatially fragmented Apies River Island as 'other space' between city and suburb?

1.10

Design Informants: Architectural and Conceptual Intention

By reimagining existing infrastructure as part of the production of form and space, the marginalised urban voids are regained for innovative design interventions, alternative occupation, and a new public appropriation that connects the city to the water. The proposed intervention aims to become an architectural filter as an extension of the existing infrastructure of the urban realm, Church Street and the regenerated Apies River Island, that:

- contains and activates recreational potential;
- offers new public space through establishing a relationship between Church Street and the river;
- increases the area's ecological contribution through reinscribing an identity;
- amplifies its historic and cultural significance through establishing a relationship between the proposed interventions and historical remnants on the surrounding site;
- capitalises on the spatial, material, and socio-economic possibilities of infrastructure; and
- provides an enigmatic experience beyond its infrastructural use.

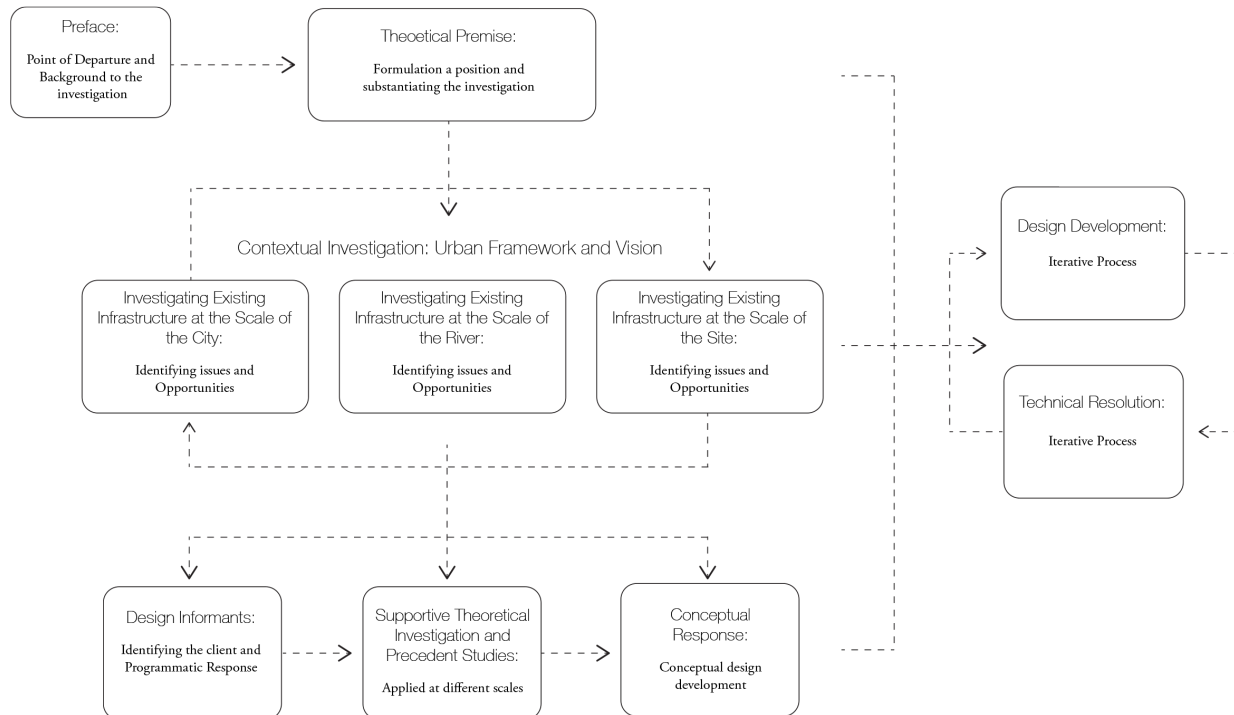
1.11 Methodology

An iterative process of consolidating different research methodologies and their findings is used to fully comprehend the urban processes of transformation as well as the potential directive effects of the proposed interventions within the context of the city, river and site, as set out in the methodology diagram. These will include:

- Literature studies on the transformation of Pretoria's spatial landscape.
- A contextual investigation that involves mapping and comprehending the palimpsest of urban transformation processes, apparent observations, and the extraction of intricate subversive underutilised opportunities and networks.

- A detailed site investigation to observe, document and transmit through drawing and other representational methods, the quantitative and qualitative information site constructs.
- Design research as an iterative analysis of proposals within the contextual field.

A synthesis of these readings and investigations will provide a collective body to inform a point of departure as foundation for the project.



02

CHAPTER TWO

THEORY

Introduction

Exploitation, Convenience and Control: Will the river die of thirst?

Hybridisation : Cities as Collective Cultural-Natural Artefacts

The Spheres Theory

Architecture, Nature and Artificial Environments

2.1

Introduction

*Instead of network and organism, the new infrastructure creates enclave and impasse:
no longer the grand récit but the parasitic swerve.*

(Koolhaas 1994:1264)

Most of our natural systems, especially water in the urban context which is irresponsibly interpreted as a standing resource, have fallen victim to unprecedented control by society, through the advance of modern civilisation and industrialisation in the 20th century.

... [A]n open field, unchallenged and without impediment to free colonisation.

(Gans 2004)

This statement clearly communicates man's perception of the natural landscape as introduced by the industrial revolution, discussed by Gans in the article "The sky above and the ground below Emscher", on the investigation of 'brownfields' – sites destroyed and contaminated through the development of urbanism and industry, and which include examples ranging from great water thoroughfares to landfills.

Consequently, this position resulted from a paradigm that created a clear separation between cultural society and the biophysical environment, and was mostly influenced by the theoretical positions proposed by Francis Bacon, Rene Descartes and Isaac Newton following the Age of Enlightenment, also known as the Age of Reason.

In non-Western societies, including South Africa, this ontological division has resulted in a critical disparity in not only the relationship between human and nature, but also in social relationships, by enabling the control of people through the control of natural resources. The South African Modern project and specifically the Apartheid planning strategies, involved urban transformation processes and infrastructural developments underlined by political ideologies, such as racial or class segregation in spaces, settlements and movement networks, as well as the provision and management of infrastructural services to selected areas. These were implemented as a mechanism for control and dominance, rather than in recognition of the interconnected relationship between cultural and natural entities.

Today this creates immense challenges for the integration of cities that were once divided on several social and spatial levels (Nuttall & Mbembe 2007).

The consequences of this modern paradigm are discussed further in the following section through a focus on water and natural environments in our urban landscapes, as supported by the writings of Bruno Latour, J.L. Monroe and Peter Sloterdijk. Latour specifically recognises the importance of comprehending the dichotomy that underlies the modern paradigm in order to progress towards new ways of critically reconstructing the abovementioned relationships (Latour 1993:10).

In current architectural discourse, fundamental questions are being posed regarding the rehabilitation of our post-industrial urban landscape, to encourage a balance between ecological and human needs. The tension between the demands of ecology and development need to be investigated when approaching these sites of concern to ultimately integrate multiple perspectives from different disciplines.

The theoretical premise of this dissertation argues that the spatially fragmented public realm of our cities' present condition owes its existence to the great divide between nature and culture of the modern paradigm, and the development of industrialisation and urbanisation controlling natural resources in isolated networks of infrastructural systems, as vehicles for political, social and economic agendas. Despite these infrastructural developments allowing urbanisation to take place in previously dangerous and impractical locations, the presence of nature in cities has been rendered anonymous, its potential opportunities as resource and amenity with enigmatic characteristics have been removed from society and the city. A reinterpretation of our development processes is required that acknowledges non-human natural systems as agents and also acknowledges the constraints of human practices in moving towards an ecosystemic approach .



Figure 2.1: Water Infrastructure being implemented on the Kleine Emscher in Duisburg (Wuppertal 2013)
Image edited by author



Figure 2.2 "Artist's interpretation of Safavid-era Isfahan, typically described as the pinnacle of garden cities interspersed with harmoniously-designed pavilions and spacious thoroughfares" (AJAM Media Collective 2012)



Figure 2.3 A graphic illustration for the invitation of the Winter 2011, University of Michigan Taubman College, The Raoul Wallenberg Competition Studios. The competition studio aimed to investigate "... ways of redefining the highway's relationship to the city, the studio will explore possibilities of transforming the often undifferentiated and mono-functional network into a performative and productive urban system, which utilizes their potentials as the "spatial" infrastructure beyond its original utilities of mobility and conveyance." (Hwang & Moon 2011)

2.2

 Exploitation, Convenience and Control:
 Will the river die of thirst?

Without water there is no life; therefore it is only natural that it should occupy a great place in the history of humanity and the world.

(Manore 2006:230)

Water is a discreet component with a pervasive presence in our natural and built environments. Not only fundamental to life, but rather life itself, it is an integral component of the cellular structure of living organisms and facilitates every occurrence of human habitation. Water as unifying element of all living ecosystems defines the landscape. Encompassing much more than the combination of hydrogen and oxygen molecules, it has been assigned various identities throughout history in the spheres of politics, economics and religion, imagined in terms of its power, fertility and fortune.

2.2.1

The First Dichotomy

The regulation of water through the management and control of rivers during the sixteenth century, anticipated the mechanisation of the natural systems during the seventeenth century, with the revival of the Roman development of science, specifically hydraulic engineering through the construction of aqueducts (Manore 2006:232).

The advent of the seventeenth century threatened the organic view with a paradigm of mechanisation and was soon to be replaced by a new theory of natural and cultural organisation. The most influential theories that stimulated this paradigm shift are considered to be that of Francis Bacon (1561 - 1626), Rene Descartes (1596 - 1650) and Isaac Newton (1643 - 1727).

In his book *Novum Organon Scientiarum* ("The new instrument of science"), published in 1620, Bacon proposed his 'true' directions regarding his interpretation of nature. His reductionist theory of rational thought proposed that, through a scientific investigation and the use of reason, humanity has the potential to master all things.

Let the human race recover that right over nature which belongs to it by divine bequest.

(Bacon 1620:115)

Similarly, Descartes, in his publication *A Discourse on Method* (1637), proposed that the natural world consisted of inert particles, lifeless and mechanistic in its processes.

Newton's theory further advanced Descartes' arguments by suggesting that nature's particles were not inactive, but rather moved as a result of external forces. The ability to comprehend and manipulate these forces was thought to enable every human desire. Their theories together positioned humans as separate from and dominant over the natural world. "They rearranged the cosmos, society and the self in terms of the machine" (Manore 2006:232). Herein lay the foundation of the nature-culture opposition significant to modern society's theoretical fundamentals and the philosophies of development.

The refining of natural science as a unity of facts, and a realm separate from society and culture, is how Bruno Latour describes this modern paradigm in his book *We have never been modern* (1993:11):

... [A] partition between a natural world that has always been there, a society with predictable stable interests and stakes, and a discourse that is independent of both reference and society.

(Latour 1993:11)

The development of modernism, with this new separation between humans and the natural world, and an emphasis on order and power as the ability to actively control the affairs of the natural environment through the process of industrialising the world, ultimately removed any consideration for restrictions on environmental exploitation.

For most of the year they typically amount to a steady trickle; then with a sudden thunderstorm or an early thaw they raged and rampaged, tearing out everything put in their way, wreaking havoc over a vast floodplain. All those natural imperfections would have to be set right. Science demanded a nature without flaws.

(Worster 1985:154)

For water in the urban environment, this meant the manipulation of and aspiration to transform the integrity of natural systems into agents of power and control and to successively mitigate any possibilities of change, uncertainty and unpredictability. Donald Worster (1985:154) encapsulates the conditions that encouraged the desire for the modernisation of these natural forces.

During the course of modernisation and urbanization, rivers have been systematically engineered to provide particular

services and functions to our societal functions, but as an unintended consequence, our engineering resources ultimately removed their ecological potential (Mador 2008:48). Most rivers and water bodies have been manipulated as projects to serve singular objectives, taming, subduing and marginalising these former lifelines of all pre-modern environments into inanimate, artificial objects of which the division of the modern paradigm is an underlying problem.

2.2.2

The Second Dichotomy

Assurances of Nature's abundance and Man's abilities continued to prosper during the industrial development and urbanisation of the 20th century. The intrinsic design qualities of pre-modern natural and artificial places have been encroached on by the imposition of uniform networks of infrastructure, driven by mechanistic development and efficiency. Environmental resources have been overpowered by the supposed need in the present urban landscape for control, functionality and connectivity. Despite its utilitarian importance to the service of urban development, the distinction between these two realms have given rise to the dominance of culture over the suppression of natural resources, instead of the recognition of their inherent hybrid composition. Today however, we are able to recognise the shortcomings of these great achievements and technological advancements.

Our natural environment is no longer viewed simply as a collection of resources to be exploited, and neither should our infrastructural implementations be considered as projects dedicated to isolated functions and services. "Instead, the world and the many formations which compose it, be they continents, cities, industries, habitats, bodies (human, nonhuman organic, nonhuman technological), are all hybrid assemblages of, and in, heterogeneous entanglements or networks" (Jones 2009:6).

The past decade has seen many initiatives attempting to challenge the modernist world view of a nature/culture

duality through the immersion of ecological interventions. People are once more considered integral components of the larger ecological system under this 'ecological' view of society, with the objective of creating communities in equilibrium with their environments. The premise of these interventions are the search for a symbiotic relationship between and interconnectedness of all human and non-human agents as well as a concern for nature as a living entity.

To do so would require an agreement that no river would be appropriated in its entirety, nor be constrained to flow against its nature in some rigid, utilitarian strait-jacket, nor be abstracted ruthlessly from its dense ecological pattern to become a single abstract commodity. ... Where watersheds are degraded by urbanisation, then rivers will also be degraded. Maintaining or restoring watersheds and rivers with wetlands and healthy soils, minimises damaging flash floods and the risk of drought, cuts down soil erosion and so the amount of sediments washed down in the riverbed, increases the ability of the river system to break down and filter pollutants, and provides diverse wildlife habitats.

(Manore 2006:243)

What is required is a new metaphor for human-nature collaboration, as opposed to dualism or dichotomy, through a revival of the countless opportunities provided by ecological potential.

2.2

Hybridisation: Cities as Collective Cultural-Natural Artefacts

The first advancement in acknowledging our present hybrid reality would be to progress beyond the recognition of nature and culture as existing yet interrelated entities, towards a realisation of the world where its attributing aspects can no longer be classified as either realm, but only identified as a culmination of less significant differences between the two realms (Jones 2009:17).

The new metaphor and position put forward by Latour is the idea of hybridisation and agent parity between non-human and human actors in an interdependent network. He argues that the world is organised of hybrids between fact and myth, nature and culture, and society and science. It is impossible to separate these arrangements and we can only interpret and create hybrids in our understanding of reality (Latour 1993:10).

Hybridity therefore emphasises the impurity of individual entities as opposed to an assembly of elements from both nature and culture.

All of culture and all of nature get churned up again every day. ... Headings like Economy, Politics, Science, Books, Culture, Religion and Local Events remain in place as if there were nothing odd going on. The smallest AIDS virus takes you from sex to the unconscious, then to Africa, tissue cultures, DNA and San Francisco, but the analysts, thinkers, journalists and decision-makers will slice the delicate network traced by the virus for you into tidy compartments where you will find only science, only economy, only social phenomena, only local news, only sentiment, only sex. ... By all means, they seem to say, let us not mix up knowledge, interest, justice and power. Let us not mix up heaven and earth, the global stage and the local scene, the human and the nonhuman. 'But these imbroglios do the mixing,' you'll say, 'they weave our world together!'

(Latour 1993:2)

Latour's introduction of a theoretical position which prioritises negotiations, interpretations and the heterogeneous relations that associate objects (human and non-human) challenges the intellectual divisions that modernity introduced, in order to arrive at an adequate understanding of how humans relate to science and technology (Lecomte 2013:463).

He further confronts modernisation with ecology. In a Latourian understanding, ecology challenges the preservation of nature through an emphasis on the infrastructures and multifaceted associations that exist between and support both the domains that modernity separated. He argues that the uninterrupted networks that allow us to simultaneously interpret scientific knowledge, political action, nature, economy and culture, do not 'mysteriously circulate', but are collected, calculated and associated with great consideration and effort, which is of great significance to our interest in constructing environments as architects (Lecomte 2013:464).

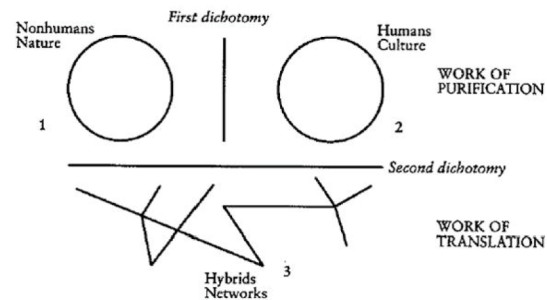


Figure 1.1 Purification and translation

Figure 2.4 Graphic illustrating the theoretical principles of the First - and Second dichotomy of the Modern paradigm (Latour 1993:11)

2.3

The Spheres Theory

A brief synopsis of Peter Sloterdijk's spheres theory provides insight into the relevance and opportunities of this hybrid reality for the design profession and, more specifically, architecture. In relation to architecture, Peter Sloterdijk has united the divided modern entities into "spheres" or environments. These "spheres", as termed by Sloterdijk, are used to describe the carefully designed artificial environments humans find for themselves to inhabit and is well encapsulated by a quote by Latour from the keynote lecture for the Networks of Design meeting of the Design History Society at Falmouth, Cornwall.

... [W]e are enveloped, entangled, surrounded; we are never outside without having recreated another more artificial, more fragile, more engineered envelope. We move from envelopes to envelopes, from folds to folds, never from one private sphere to the Great Outside.

(Latour 2008:8)

He further states that the ecological crisis has revealed the inherent hybrid identity of a cultural-natural reality and that a pure "outside" natural environment no longer exists (Latour 2008:8). Sloterdijk's main argument is that whoever designs and whoever occupies an environment also determines and regulates the actions and occurrences within it. Through this premise, Sloterdijk has reconstructed a fundamental principle of modernity, in pursuit of a comprehensive ecological design and the organisation of potentials and expectations that come along with it.

An amalgamated emergence of an innovative reconstruction is required, based on balancing human infrastructural needs with ecological systems. Understanding these systems within the urban context is important to unveil not only living nature, but also its ability to restore individual and collective livelihoods in the city.

2.4

Architecture, Nature and Artificial Environments

The definition of the Greek word Phýsis is used to describe what is constant and what is irreversibly transforming at the same time, and is used to define that which is continually generated or produced. Hence nature is understood as a series of laws that govern change (Natoli 1992:102). This 'generation' reaches its full consciousness in the human life cycle. In their artificial actions, human beings are merely conforming to nature's laws.

Human beings are therefore "natural artificers" in which the natural world and the artificial world come together in a perfect cycle.

(Natoli 1992:103)

Human beings are not denying nature or its laws, but are artificially constructing this natural generation or production when changing the environment through the imitation of nature.

We can therefore acknowledge that the manipulation of nature is perfectly natural; however, nature as sacred is entirely unnatural and challenging to sustain. It is critical in this regard to determine when the manipulation of nature becomes autocratic and when technological advancements become hazardous rather than supportive.

Even though the laws of nature are regarded as everlasting, their forms of production are not. Death can be delayed, but it is inevitable. Therefore there is no point in attempting to return the environment to a more natural state, but the ability of human beings to control nature is limited or restricted. With our current technological developments, the possibilities of manipulating nature is advancing to the core of its functioning and structure – for example artificial intelligence and genetic engineering – and is no longer restricted to its appearance, making natural forms more adaptable without damaging them (Natoli 1992:103).

It is critical to consider the compatibility of these developments with their environments and determine what could be adapted and what should stay constant, while being fully aware of the counter-effects that our technological innovations may initiate. An innovative approach does not submit to limitations, but rather redefines them. Nature is unavoidably altered by the technical advancements of men and is visually understood as a cultural perception, hence it becomes apparent that nature as a pure entity is considered fictional. If artificiality is an inevitable realisation in the relations between man and objects, it is fundamental that we abandon the artificial strategies employed to control nature (Natoli 1992).

Architecture has always been an imitation of nature, although its fundamental intention is considered to be shelter from natural elements. Similarly, the city has always been an artificially constructed urban landscape of consumption and exploitation to the expense of natural resources.

In this regard it is important to separate imitation from authority and to acknowledge architects such as Alvar Aalto and Richard Neutra, who have through the modern movement acknowledged natural dynamics as a framework for architecture (Hagan 2001:22). According to Hagan in *Taking Shape: A new contract between architecture and nature* (Hagan 2001:16), architecture has always held an ambiguous position and is moving towards greater ambiguity with an emphasis on artificially pursuing environmental sustainability.

The simultaneous acknowledgment of this new integrated paradigm and the possibilities of our technological advancements, presents an unfamiliar yet excitingly favourable territory for redefining and reimagining architecture and infrastructure within the realm of the artificial, to create an overlapping and integrated domain founded in both nature and culture (Hagan 2001:16).

03

CHAPTER THREE

CONTEXT: FIRST READING

INFRASTRUCTURE AT THE
SCALE OF THE CITY

Introduction

Investigating Infrastructure through Boundary and Symbolism

3.1

Introduction

Establishing an architectural approach to infrastructure is challenging, as at the scale of architecture, the effects of infrastructure are almost absent in contemporary discourse, and at the scale of the city, the extent of its significance appears to be declining with the increased implementation of isolated systems and networks, presenting the nature of infrastructure in the present condition of our cities as static and stable, an ubiquitous utilitarian presence, dominated by economics and efficiency (Seewang 2013).

An architectural lens for investigating an alternative method for the development of existing infrastructure in our cities would be beneficial, as an architectural approach synthesises an array of information, positive opportunities and constraints in design criteria, and reimagines them into positive attributes of built form. A fundamental strength of an architectural methodology for this approach is the ability to transform qualitative information into a formal response, creating an approach that integrates the built form of the surrounding urban landscape, the social networks and economic opportunities, as well as the ecological potential and constraints, in order to fully comprehend the spatial consequences produced by the implementation of public infrastructure.

The contextual investigation therefore considers infrastructural development in three separate chapters (Chapter 4:Infrastructure at the Scale of the City, Chapter 5:Infrastructure at the Scale of the Apies River, and Chapter 6:Infrastructure at the Scale of the Site) as layered readings building a collective image of the project's contextual conditions.

In Chapter 4_Infrastructure at the Scale of the City, the first reading proposes an investigation of infrastructure through an understanding of its boundaries of influence and significance, in order to create a collective understanding of the image of the city as a complex site of social, political and economic forces that facilitate natural resources in order to supply urban needs.

The architectural parameters for the first reading are inspired by the work published by S. Carlisle and N. Pevzner in Scenario Journal 03, “Introduction: Rethinking Infrastructure” (2013). This publication discusses a collection of investigations regarding infrastructure at various scales and from a range of disciplinary perspectives. It builds on ideas from projects developed in accordance with Kevin Lynch’s symbolic characteristics of identity in cities and neighbourhoods; and on O.M. Ungers’ and Rem Koolhaas’ Green Archipelago approach for redesigning urban island boundaries at their 1977 Summer Academy; that specifically focussed on rescribing and reinventing existing city boundaries and infrastructure towards a collection of decentralised centres. As opposed to the focus on designing new cities with singular central cores.

The second reading of the Apies River as important infrastructural entity within the city of Pretoria is further investigated in Chapter 5_Infrastructure at the Scale of the Apies River, in order to propose a vision for the future extended boundary of effects within the city context. This investigation identifies the historical and formal particularities of the Apies River infrastructure through defining its present condition and constituents within the city, and illustrating the historic and current symbolic role of these as actors that respond to and transform the development of the ecological corridor.

At the scale of the site and surrounding precinct, the third reading, Chapter 6_Infrastructure at the Scale of the Site, extracts and investigates the existing infrastructure as a series of isolated networks of ecological, water, transport and social infrastructure, based on the ecosystemic masterplanning principles as set out by architect Ken Yeang in his recently published book, Ecomasterplanning (Yeang 2009:16). This ecosystemic approach proposes an alternative understanding of sustainable development as a dynamic assembly that integrates all four infrastructural categories, in order to provide an informed speculation and alternative solution beyond the current paradigm of static, ad hoc implementation of infrastructure that addresses present conditions without any

3.2

Investigating Infrastructure through Boundary and Symbolism:
The city as a complex collection of forces

The concepts of boundary and symbolism are central to architectural discourse. Boundary is typically understood to be the line that indicates the meeting point of the building and the surrounding context, such as at the sidewalk, street or adjacent site, whereas symbolism is understood through the communication of the building language and presence through massing, form, scale and tectonic resolution, all contributing to the architectural identity (Seewang 2013).

The first reading analyses the collective image of the city through the boundary of influence and the symbolism of its consecutive infrastructural developments. The application of these parameters reveals the agency of specific projects in the broader city, and the cultural context that allows for a reinvention of architecture and urban space that are integrally produced through infrastructural development, capitalising on political, social and economic potential – as alternative to the present condition of architecture and public space created as an independent layer upon a neutral base of uniformly distributed service networks.

An example of political, social and economic factors influencing the implementation of infrastructure and architecture, and thus reflecting a particular urban culture could be read in the grid, structure, grain, form and symbolism of significant streets in the city of Pretoria, such as the transformation and significance of W.F. Nkomo Street running from Pretoria West, extending into Helen Joseph Street in the city centre and becoming Stanza Bopape Street that extends to the eastern residential suburbs – the extent of former Church Street.

An apparent change in grid and development grain from the city centre represents the cultural identity and activities as displaying a large-scale commercial and bureaucratic condition to its northern boundary, with Marabastad situated north-west of the city centre as having a fine-grained, more informal economic condition, stimulated by active street conditions as opposed to internalised activities.

The symbolic significance of streets therefore gives order to and represent the culture of a city beyond their primary use as transportation and services infrastructure.

Both quantitative and qualitative research were used to create a series of composite maps of the city that represent a concurrent relationship between infrastructural projects and the development of the city over time. This series of maps illustrates the transformation of Pretoria's early infrastructural projects, that acknowledged and were evidently connected to the capacity of its natural resources, into the present, isolated networks controlled by a modern industrial capital. The architectural nature of this investigation allows for an understanding of the consequential transformation of contemporary cities and simultaneously inspires a response that remains architectural in nature, while addressing broader spatial concerns at a city scale (Seewang 2013).

Map 1: 1600s – 1825

The natural infrastructure of the early Pretoria region

The natural topography of Pretoria presented a protected terrain between the surrounding mountain ranges and koppies, with accessible water as source of life for the various tribes occupying the Pretoria region. An Ndebele tribe led by King Mzilikazi settled in the region by establishing two military kraals along the Apies River (Huffman 2010)

Map 2: 1837 – 1857

The establishment of the town of Pretoria

The first farmland titles:

In December 1837, General Hendrik Potgieter successfully evicted the Ndebele tribes from the region and the first White inhabitants, Lucas and Gert Bronkhorst, registered the farms Groenkloof and Elandspoort in Pretoria. Groenkloof was situated in the Fountains Valley area, while Elandspoort included an extensive area of land with its southern boundary above Fountains Valley, extending to Daspoortrand in the north and from the west of Pretoria through to its eastern boundary where Hatfield is presently located. In 1853, Marthinus Wessel Pretorius, son of Andries Pretorius, purchased Elandspoort and Koedoespoort, and declared it to be the town of Pretoria (South Africa History Online 2015).

The establishment of the Church Square Kerkplaats and grid layout at the confluence of the Apies River and openings (poorte) in the surrounding mountain ranges:

The city of Pretoria was founded by President M.W. Pretorius who commissioned the first public square for church and market purposes, known as Kerkplaats, or “Church Place”. Church Square was situated on the crossing of Church and Market Streets as central symbol of the establishment of the town. The history of Church Street predates the establishment of the town. It served as trade route between Delagoa Bay and Potchefstroom, at the confluence of the Apies River and Walker Spruit. The consequential grid development of the town was confined by two natural watercourses, namely the Apies River and Steenhoven Spruit to the east and west respectively, as well as the openings (poorte) in the northern and southern bounding mountain ranges as access points to the city centre (South Africa History Online 2015).

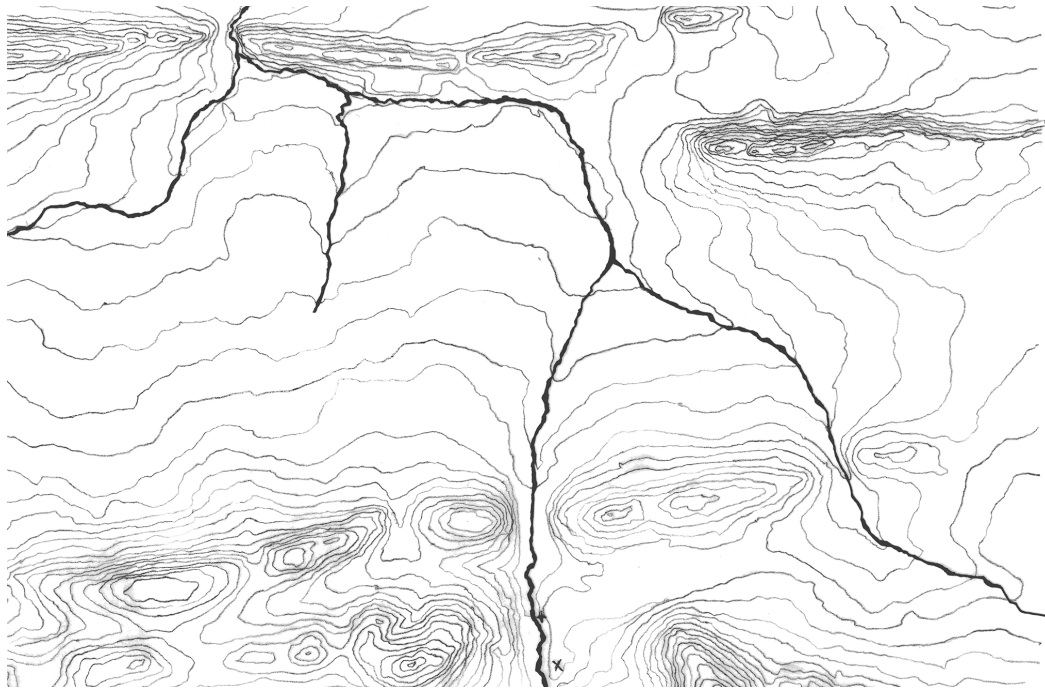


Figure 3.1: Map 1 - The natural infrastructure of the early Pretoria region. (Author 2015)

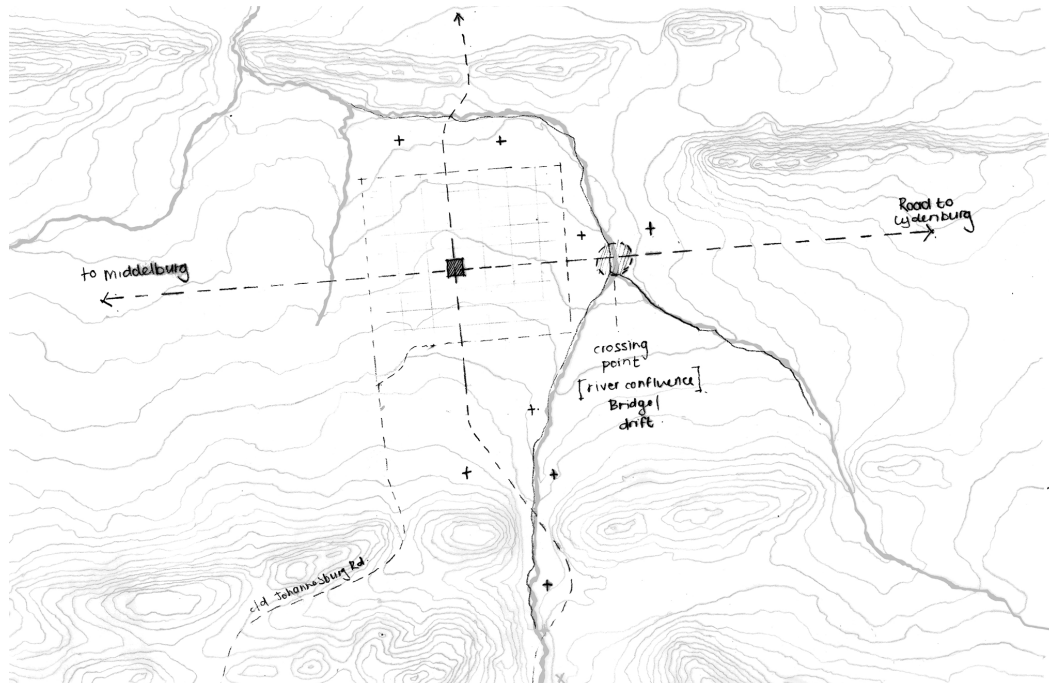


Figure 3.2: Map 2 - The establishment of the town of Pretoria. (Author 2015)

Map 3: 1880 – 1910

The water reticulation network, canalisation of the Apies River and construction of the Lion Bridge, allowing further development of the city's first suburbs and reinforcing the significance of the Church Street axis.

In 1890 the first water infrastructure was implemented, comprising a 12 inch (300 mm) diameter aqueduct conveying water from the Fountains Valley into the centre of the town, as well as a cast-iron reticulation network serving the extents of Pretoria Central and Trevenna.

At the crossing of Church Street and the Apies River, the construction of Lion Bridge (Leeubrug) was completed in 1894. Designed by S.W. Wierda, first engineer and architect to the South African Republic, the Lion Bridge as remarkable sandstone structure, elaborately ornamented with symbolic bronze lion figures on pedestals, reinforced the significance of Church Street as main axis between the town centre and surrounding suburbs.

The canalisation of the Apies River soon commenced and took place from 1909 to 1930, after a heavy rainstorm resulted in flooding, damage of property and loss of life along the river. Development pressures and the river's relegation to human engineering through canalisation and bridge construction transformed it from a natural threshold with significant ecological potential into a concrete, restricted, linear entity. The control of this natural entity, however, allowed further urbanisation of the surrounding suburbs Arcadia, established in 1889, and Sunnyside, established in 1890, to occur (South Africa History Online 2015).



Figure 3.3: Map 3 - The The water reticulation network. (Author 2015)

Map 4: 1892 – 1910

Electricity and transportation infrastructure led to the expansion of the boundaries of urbanisation and reinforced the importance of the Church Street axis.

Electricity infrastructure:

The first electricity infrastructure was implemented in Pretoria during 1892, with the power station erected on Frances Baard (formerly Schoeman) Street. The introduction of electricity enabled a range of consequential infrastructural developments that expedited urbanisation, such as the electric tram system and various industrial opportunities leading to the establishment of Pretoria West.

Transportation infrastructure:

In 1892 the first railway station was erected in Pretoria, with the official opening of the Delagoa Bay railway line in 1895. Electric trams were soon introduced as public transportation between the city centre and adjacent suburbs of Arcadia and Sunnyside, with the Municipal Tram Sheds constructed on the corner of Lilian Ngoyi (formerly Van der Walt) and Frances Baard (formerly Schoeman) Streets in 1912, some of the structures of which are still maintained and occupied by shops today.

Water infrastructure – the sewerage system:

In 1903 the first formal sewerage system was implemented in Pretoria, following the deterioration of hygiene in the town due to poor maintenance and inadequate water and sewage practices. A report in *Die Volksstem* of 8 August 1877 stated: “The homesteads in Pretoria, how fearfully the smell; there’s fever in the furrow, there’s sewage in the well”.

Reinforcing the symbolic significance of the Church Street axis through political significance:

Pretoria was assigned to become the administrative capital for the new government, and in 1909 Herbert Baker was appointed to design the building that symbolises the Union of South Africa on Meintjieskop. The boundary of the site is located on the significant Church Street axis. The cornerstone was laid in November 1910 and construction of the Union Buildings was completed in 1913.

The following suburbs were established shortly after the implementation of these infrastructural developments, consequently furthering the development of the city.

- 1892 Pretoria West
- 1896 Mayville, Eloffsdal and Villieria
- 1897 Hermanstad
- 1898 Roseville and New Muckleneuk
- 1902 Brooklyn, Gezina, Wonderboom South, Rietfontein, Parktown, Mountain View and Claremont
- 1903 Pretoria Gardens, Daspoort, Rietondale and Waterkloof
- 1905 Lady Selbourne, Hatfield and Booyens

(South Africa History Online 2015)



Figure 3.4: Map 4 - Electricity and transportation infrastructure. (Author 2015)

Map 5: 1910 – 1968

Fragmented urban development due to the implementation of vehicular transportation infrastructure as isolated network of control and convenience, upon (instead of integrated with) other layers of infrastructural development.

Major Vehicle Transportation network:

With the last tram leaving Church Square in 1939 and the introduction of petrol busses to the city in 1968, the focus of transportation infrastructure shifted to larger projects of vehicular networks around the city, such as Nelson Mandela Drive, a 10 lane motorway at its widest, hindering pedestrian ease of access and dissecting the city into fragmented public realms. One of the unrealised proposals includes the 1967 Ringroad Highway proposed to be positioned around the city centre, with the intention of establishing a total of 13 roads in order to provide additional carrying capacity in the north-south direction.

The development of an extensive vehicular network drastically increased Urbanisation to the outer suburbs listed below:

| | |
|------|------------------|
| 1914 | Capital Park |
| 1928 | Colbyn |
| 1934 | Menlo Park |
| 1939 | Waterkloof Ridge |

Pretoria as Apartheid city

Infrastructure as control and for exploitation of political, social and economic agendas

The relocation and establishment of additional residential areas, removed from the city centre and without access to services and opportunities, largely dominated the spatial agenda of Pretoria as apartheid city. The following significant developments occurred.

- In 1923 the first pass law was implemented in South Africa as a measure of regulating the access of black Africans to white urban areas.
- Atteridgeville was established in 1939 with the first 50 families relocated from Marabastad in 1940.
- The township of Mamelodi was established in 1951 on the north-east outskirts of Pretoria.
- In 1960, Laudium was established as a residential township for Indians, and in 1962 Eersterust was laid out 15km from the city centre as an area allocated to coloured inhabitants.

(South Africa History Online 2015)

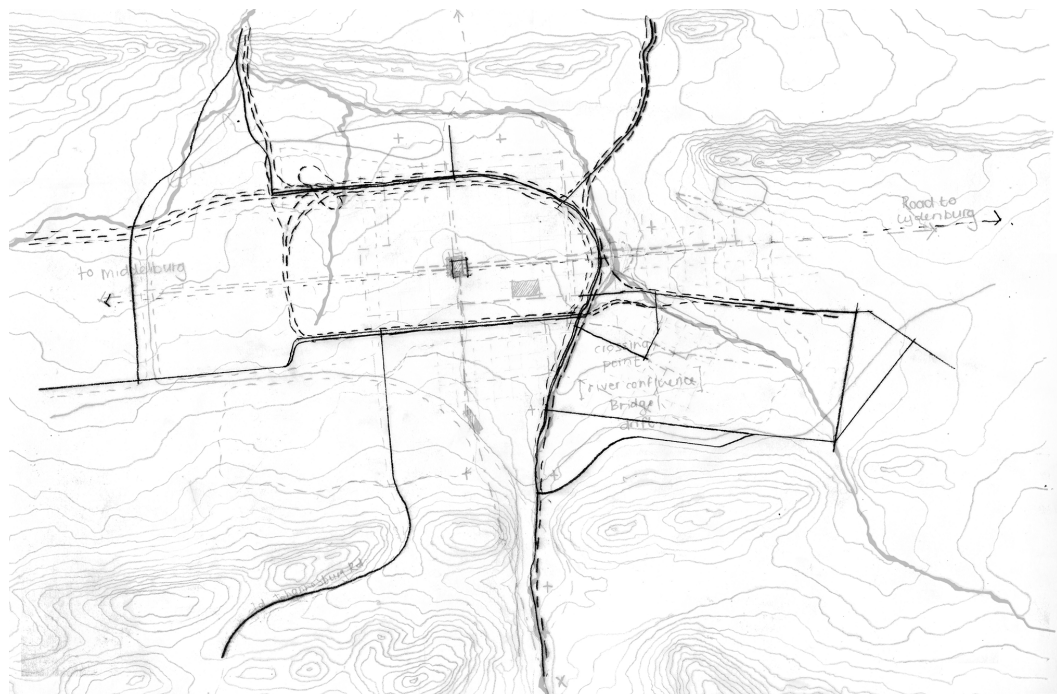


Figure 3.5: Map 5 - Fragmented urban development due to the implementation of vehicular transportation infrastructure. (Author 2015)

Pretoria as democratic city

The pedestrianisation of Church Street, implemented during 1996, extends from Bosman Street west of Church Square to Lilian Ngoyi (formerly Van der Walt) Street. The intention of this project was to improve pedestrian and public life within the city while diversifying social, cultural and economic opportunities as a catalyst to encourage further developments.

Freedom Park celebrated the democracy and freedom of the people of South Africa with the manifestation of this significant memorial in 2007. A reconciliation road was constructed in 2011, physically and symbolically linking Freedom Park to the Voortrekker Monument.

The start of a new era of public transportation commenced with the operation of the first Gautrain route from Rosebank to Pretoria and Hatfield in 2011.

Map 6: Synthesis and Extraction of potentials

Two resilient and symbolically significant entities are identified and investigated further

The Church Street axis as Ceremonial Boulevard:

Throughout the transformation of the city, the historical and present significance of Church Street as primary axis through the city is reinforced by the extent, trajectory and symbolism of the various infrastructural projects implemented and investigated in the series of maps discussed, as well as by various intangible significant historical events, ceremonies and marches.

The Apies River Corridor and ecological network:

The Apies River as natural entity dominated by the development of modernisation and urbanisation played an important role in the establishment and development of Pretoria, and offers a broad spectrum of potentials currently underutilised and to be extracted and reimagined to the benefit of the public realm.

(South Africa History Online 2015)



Figure 3.6: Map 6 - Two resilient and symbolically significant entities are identified and investigated further. (Author 2015)

04

CHAPTER FOUR

CONTEXT: SECOND READING

.....
INFRASTRUCTURE AT THE SCALE
OF THE APIES RIVER

Introduction

Timeline: Transformation of the Identity of the Apies River

Theory for the Apies River Vision

Precedents for the Apies River Vision

Vision for the Apies River

4.1

Introduction

The water cycle is one of the most critical processes to supporting life on this planet, and fresh waters are central to all aspects of our lives. Historically, urbanisation has led to the loss and degradation of wetlands, rivers and groundwater resources through pollution, resource depletion and construction within natural flood plains.

Woods-Ballard in

(Armitage, Vice, Fisher-Jeffes, Winter, Spiegel & Dunstan 2012:1)

The Apies River Corridor has undergone a series of transformations, creating tension between the urban fabric and its natural, historical and cultural significance, revealed in the subsequent deterioration of the site and landscape, and the severe contamination of the river (Dippenaar, 2013). Through various infrastructural expansions, deteriorating social conditions and increased urban development, the present anonymity of the Apies River Corridor is the result of its transformation from a significant source that initiated the establishment of Pretoria as well as being an important natural landscape and recreational precinct within the city and surrounding suburbs, to an artificial, underutilised, fragmented island.

Figure 4.2 illustrates the isolated linear network of water supply from the Fountains Springs and separate water removal system to the Daspoort Wastewater Treatment plant. The fragmented urban condition created by the implementation of major transportation networks throughout the city becomes visible as exaggerated in the graphic illustration. (Author 2015)" on page 36 illustrates the Apies River in its present condition of being removed from any public activities by the isolated infrastructural expansion of Nelson Mandela Drive, constructed without any consideration for the barrier it creates. Situated in this existing fragmented urban condition, the one-way water network of supply from the springs to the city, and a separated stormwater and sewage system of wastewater removal, renders the river's identity a large concrete drainage channel, dissecting the city and completely unintegrated with its ecological, social or potential engineering infrastructural opportunities. Sections A-A and B-B illustrate the topographical condition and position of the Apies River Corridor within the city.

We have constructed large motorways with no consideration to the absolute barrier to access they create. The Apies River, once a significant contributor to the biophilic potential within the town establishment as original source of life to the towns development; is now cut off from the city by the and infrastructural expansion of the Nelson Mandela Boulevard and the cannalisation of the river itself.

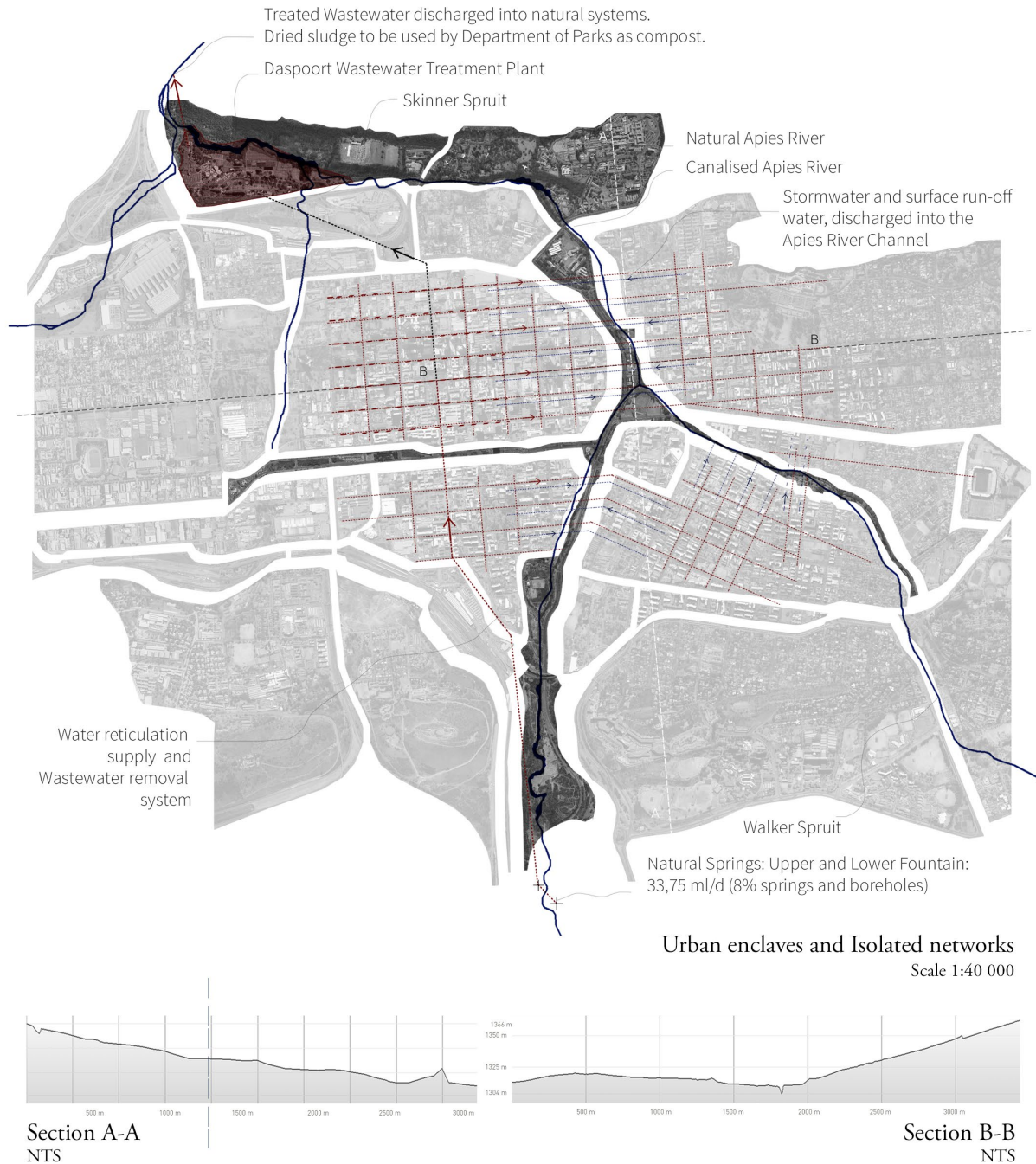
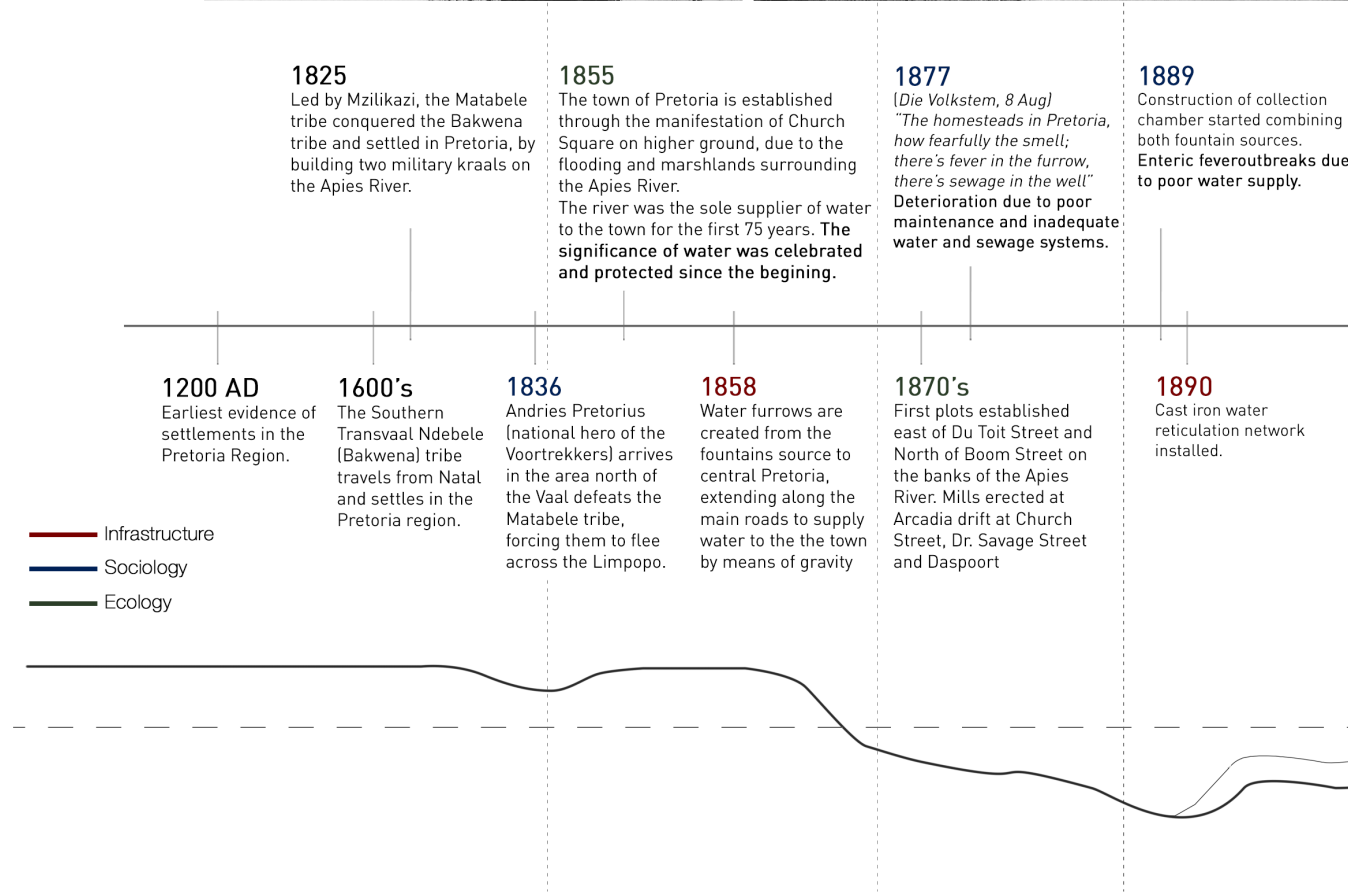


Figure 4.1 illustrates the isolated linear network of water supply from the Fountains Springs and separate water removal system to the Daspoort Wastewater Treatment plant. The fragmented urban condition created by the implementation of major transportation networks throughout the city becomes visible as exaggerated in the graphic illustration. (Author 2015)

4.2

Timeline: Transformation of the Identity of the Apies River

A timeline of the Apies River above illustrates the transformations of the river landscape in three different categories, namely infrastructural, sociological and ecological developments. The graph below the timeline indicates the positive and negative influence these developments have had on the presence of the river as natural entity within an urban context, the ecological benefits to the public realm, and finally the aims for the reintegration of these separated infrastructural networks with its potential benefits.



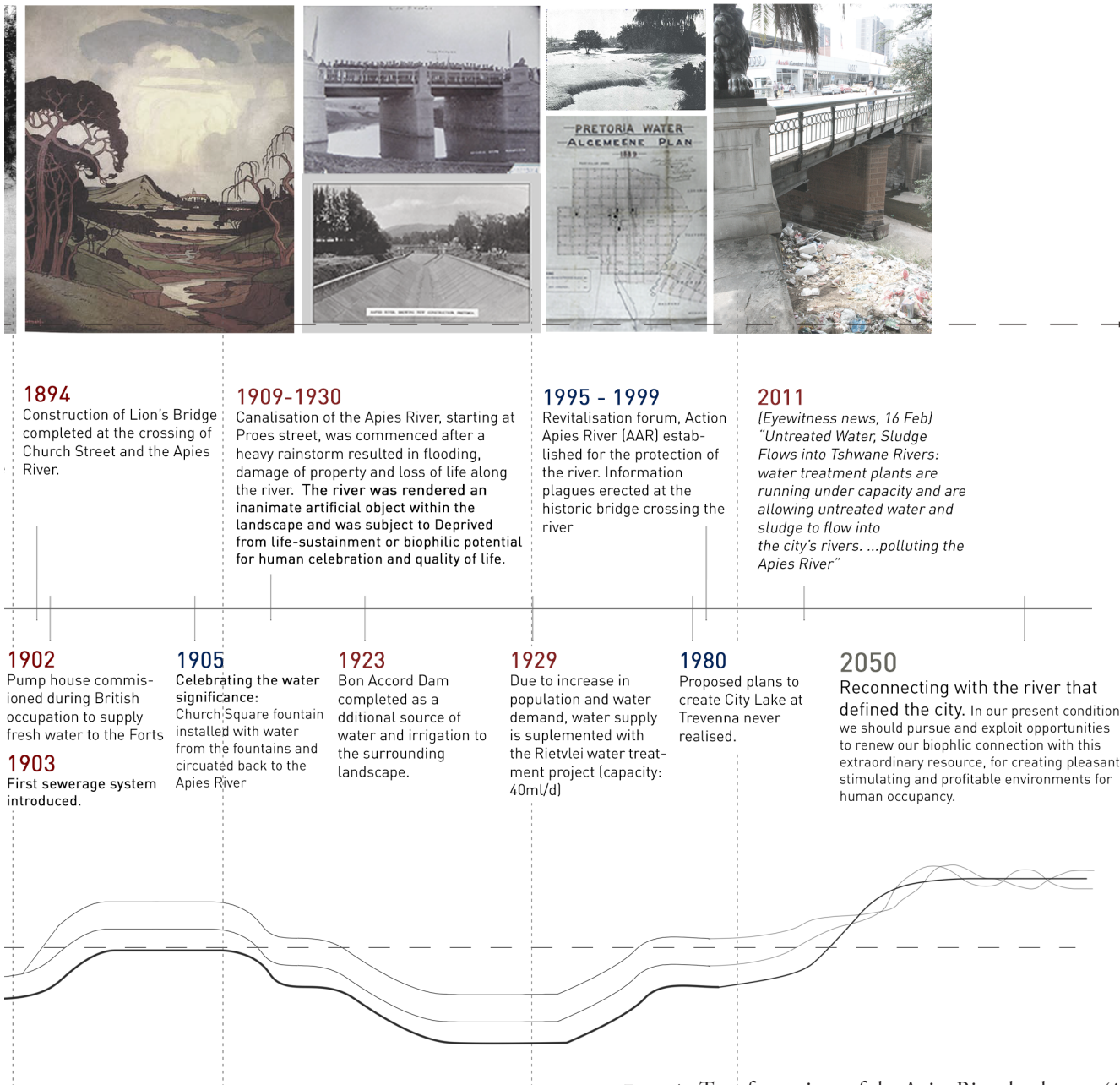


Figure 4.2 Transformations of the Apies River landscape. (Author 2015)

4.3

Theory for the Apies River Vision

4.3.1

Biophilia and Water in the Urban Context

Biophilia, a term invented by Harvard biologist Edward O. Wilson, is defined as the genetic basis for the human predilection towards the natural world (Stairs 2010:339). According to David Stairs, and although it was an unproved theory at the time, the term's development was encouraged by the intellectual community as a return to an instinctive and integrated approach to human development in the debate around climate change. According to landscape architect John Ornsbee Simonds, we still seem to share with our ancestors their instinctive understanding of working in symbiosis with the natural realm, instead of it being exhausted as resource through the control, convenience and exploitation through industrial development and modernisation by humans (Mador 2008:44).

The Apies River, as source of life for more than 160 years, defines the historical margins with which the city, its service infrastructures, and public life have developed.

Essential as source of life and well-being, water's ubiquitous presence supplements human life through basins, boreholes, mines, wells, sewage networks, stormwater drains, ground water tables, aquifers, reservoirs and many more. The identity of this important element – water – holds an extraordinary range of characteristics.

It is perceived as a colourless entity that has the ability to reflect its surroundings, powerfully animating its context through movement, light, control and sound; a liquid that holds no shape of its own, but is shaped by its contained surroundings while in return moulding the natural environment; a liquid that has the power and resistance of concrete when moving at high speed, but at the same time has the ability to submit to touch. However, its presence and significance in human existence are taken for granted and we are fearful of its power and not aware enough of it to serve us (Mador 2008:45).

We seem to associate our genetically driven need for a connection with the natural world (biophilia) with the dramatic landscapes of a red sunset in the bushveld, and excitement over the characteristics of wild animals or a mouldy smelling forest hike with an abundance of bird and insect sounds.

The transformation of the Apies River from natural course to engineered lines in a canalised concrete entombment, is flushing our most essential resource away at great speeds, not allowing it to contribute significance to its context. The canalised Apies River in its present deteriorated condition presents a lifeless inanimate object, deprived of any biophilic potential or opportunities to sustain life.

Since the availability and distribution of water is under our control, especially in developed urban areas such as the city of Pretoria, it enjoys little appreciation for its utilitarian value and no recognition of its symbolic, aesthetic or spiritual values. The potential of these qualities, especially in the case of the Apies River that was transformed from natural landscape to a concrete stormwater channel, needs to be exploited beyond its functional significance through a range of principles, as classified by Stephen Kellert (Mador 2008:44), that reflect understanding of the significance of our various associations with water's potential. These are illustrated in the adapted diagram 1, and range on a scale from the utilitarian to the symbolic. (See Figure 4.3)

We are slowly realising the reality of water scarcity and the economic value thereof, as there are limited places with an abundance of potable water to sustain the current and projected demands of urbanisation and population growth. Embracing sustainable and regenerative principles through the development of our cities allows for an opportunity to find a renewed, integrated and biophilic approach towards a symbiotic relationship with this extraordinary resource. The challenge before us now is to mediate an integrative approach between our strong utilitarian connections with water in the built environment and one that celebrates our aesthetic, symbolic, naturalistic and humanistic attachments (Mador 2008:49).

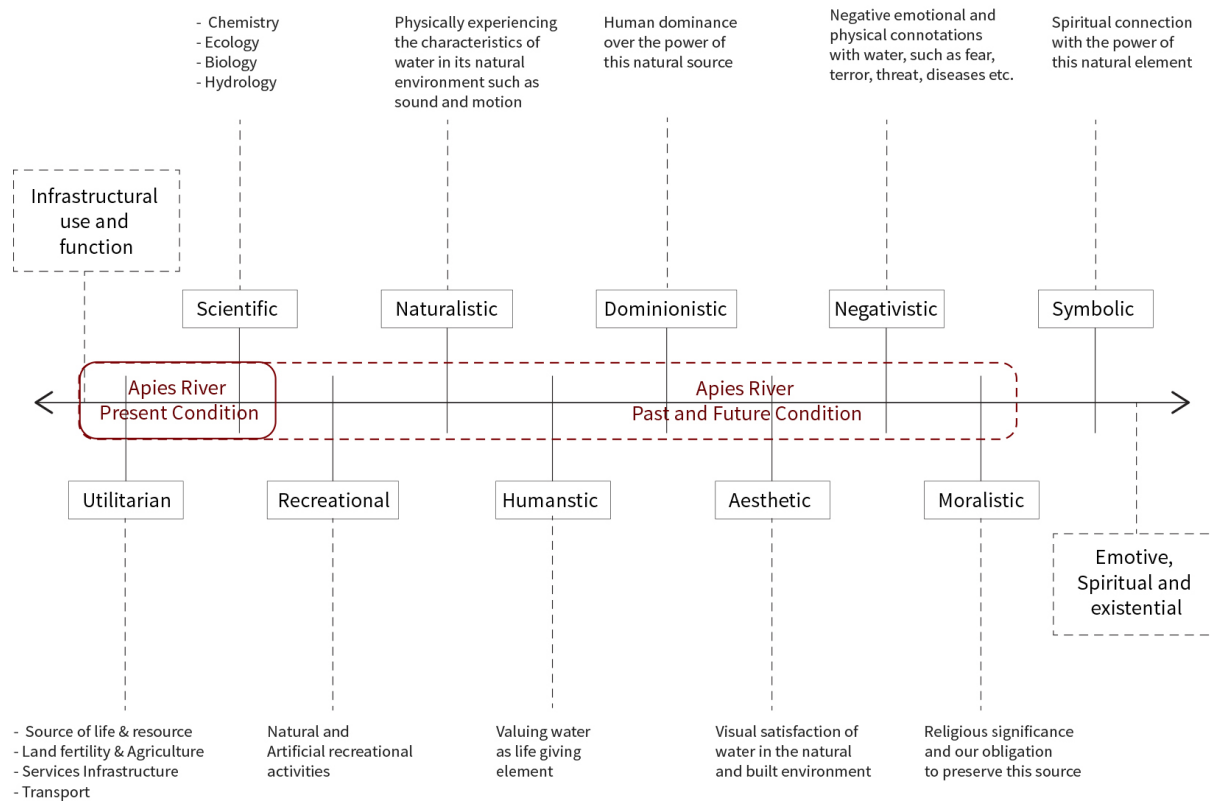


Figure 4.3 illustrates the range of principles, as classified by Stephen Kellert (Mador 2008:44), that reflect understanding of the significance of our various associations with water's potential. (Author 2015)

4.3.2

Reinventing Urban Stormwater Infrastructure: From a conveyance approach to an integrated retention approach

According to the American Society of Landscape Architects, as published in the The South African Guidelines for Sustainable Drainage Systems (Armitage et al. 2012:6), ‘ecosystem services’ are defined as “all possible goods and services that benefit human livelihoods, which are produced by ecosystem processes involving the interaction of living environmental elements”.

The canalisation of the Apies River transformed a recreational natural landscape into a concrete stormwater channel that predominantly collects runoff and channels it away from the urban realm. As with most of the stormwater management systems in the urban areas of South Africa, the preservation of its environmental potential is therefore neglected.

The design and management of urban stormwater infrastructure necessitate a shift from the isolated provision of conveyance to an ecosystemic approach. Instead of channelling water rapidly through concrete channels, stormwater design should emphasise opportunities for the harvesting, retention, re-use and infiltration of surface water to increase its ecological possibilities.

Such a paradigm shift towards an alternative approach, as discussed previously, aims to incorporate stormwater management as a component of an integrated urban water cycle, that would provide localised quantity management and quality treatment of water, enhanced amenity through socio-cultural integration, and the preservation of biodiversity, in an attempt to mitigate negative environmental impacts and exploit positive opportunities (Armitage et al. 2012:7).

Such a shift requires the understanding and implementation of natural dynamics in with our engineered systems in order to create an integrated, holistic approach that collaborates with nature, merging all aspects into a holistic perspective, instead of imposing control over natural dynamics (Armitage et al. 2012:8).

Figure 5.4 illustrates a proposed decentralised treatment network that starts harvesting and re-use on-site, while still replenishing the water system through a detention and treatment strategy towards infiltration back into either ground water or natural systems – as adapted from (Armitage et al. 2012:5).



Figure 4.4 Alte Emscher River with its biodiversity in Duisberg, Germany (Wuppertal 2013) Image edited by author.

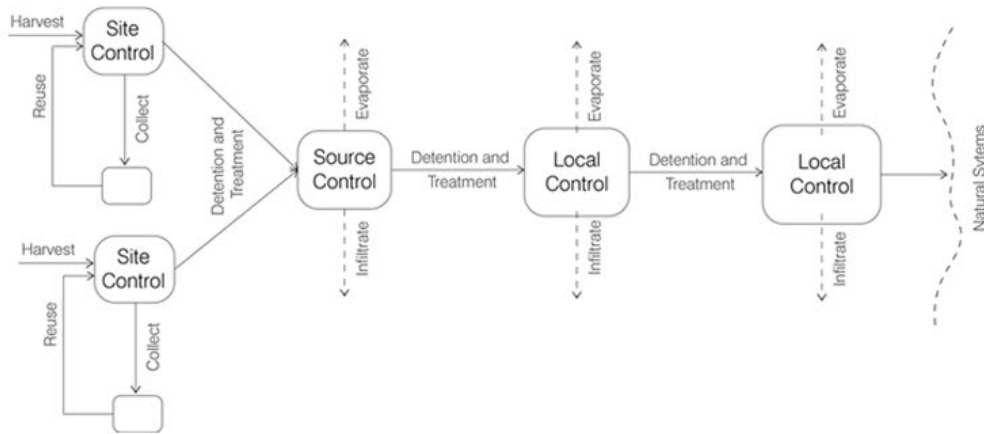


Figure 4.5 Proposed decentralised treatment network as adapted from (Armitage et al. 2012:5)

Figure 4.5 illustrates the four main considerations as well as potential sub-strategies towards exploiting the potential of water bodies as part of sustainable urban stormwater strategies, as adapted from Armitage et al. (2012:3).



Figure 4.7: Summary of the potential to the precinct when implementing an integrated stormwater approach

Figure 4.6 briefly illustrates a summary of potential opportunities through the integration of water in the urban environment with existing ecological and social-cultural conditions, as adapted from Armitage et al. (2012:4).



Figure 4.6: The four primary components of integrating urban stormwater strategies

4.4

Precedents for the Apies River Vision

4.4.1

Cheonggyecheon Restoration Project, Seoul

Project Information:

Ecologically-friendly urban waterway and park

Completion date: September 2005

Client: Seoul Development Institute
with Seoul Metropolitan
Government

Project team:

Lead Designer: Mikyoung Kim Design

Landscape architect: SeoAhn Total Landscape

Civil Engineer: KECC Engineering

Structural Engineer: CheongSuk Engineering

(Cheonggyecheon Restoration Project,
Seoul, South Korea 2011)

Background:

Originally constructed as a large drainage system for the city of Seoul, the Cheonggyecheon channel soon became a sanitation and flood risk during the 1940s when most refugees from the Korean war moved into Seoul and established informal communities along the channel banks. (See Figure 4.7) During 1958 the stream was covered, with an elevated, four-lane overpass following in 1971. By the end of the 20th century the deterioration of the surrounding fabric and public spaces desperately called for reconstruction of the stream and adjacent precincts (Meinhold 2010). (See Figure 4.8)

The restoration project removed the former highway and revitalised the 5,8 km ecological corridor consisting of three different responsive zones, creating a transition from the urban landscape to its final termination into a natural conservation area bordering the city (Cheonggyecheon Restoration Project, Seoul, South Korea 2011). (See Figure 4.9)



Figure 4.8: The Cheonggyecheon channel before the implementation restoration project, showing the implemented overpass in 1958.

Source: "Seoul under Japanese rule(1910-1945)" published by Seoul Metropolitan City History Committee.



Figure 4.9: The Cheonggyecheon channel before the implementation restoration project, showing the implemented overpass in 1958.

Source:<http://landscapeperformance.org/case-study-briefs/cheonggyecheon-stream-restoration>



Figure 4.10: The Cheonggyecheon channel after the implementation of the restoration project.

Source:<http://landscapeperformance.org/case-study-briefs/cheonggyecheon-stream-restoration>

Zone 1: Historical significance

Despite the redirection of concealed watercourses through the exposed landscape, the focus in the first zone is on the re-use of significant historical fabric, such as foundations and materials of historic bridges, as part of the regenerated landscape and public spaces.

Zone 2: Culture in the urban landscape

The integration of culture in an urban landscape becomes the emphasis of the second zone through the strategic revitalisation and addition of recreational and swimming areas in the adjacent precincts.

Zone 3: A natural landscape

The final zone emphasises the termination of the artificial corridor in a natural setting, through the overgrown remnants of the overhead and pier structures preserved on site as part of the layering of the channel history, as well as the constructed wetlands classified as ecological conservation areas.

Successful focus areas of the project:

The transportation and ecological concerns of removing the freeway was mitigated by the provision of additional public transportation and the reduction of sewage, drainage and flooding problems. Biodiversity has flourished, attracting a significant number of insect species, and has been contributing significantly to the ecological value of the urban landscape.

The economic sustainability of the project has been proven to be successful by the estimated 18,1 million visitors by the end of 2008. A diverse range of additional public facilities was established on the channel banks shortly after the restoration, which includes the Cheonggyecheon Museum holding temporary and permanent exhibitions on the history and reconstruction of the project (Cheonggyecheon Restoration Project, Seoul, South Korea 2011).

Critique:

In critically evaluating the project it becomes clear that the channel, constructed below street level, provides pedestrian access to partially enclosed and covered areas within the 200-year flood line, without clear or easily accessible escape routes. This oversight could potentially pose a flood risk to any pedestrian or recreational activities occurring within these confined spaces.



Figure 4.11: The Cheonggyecheon channel activities at night underneath a transportation overpass

Source: <http://inhabitat.com/how-the-cheonggyecheon-river-urban-design-restored-the-green-heart-of-seoul/cheonggyecheon-river-19/>



Figure 4.12: Photograph illustrating public recreational activity along the reconstructed Cheonggyecheon channel

Source: <http://inhabitat.com/how-the-cheonggyecheon-river-urban-design-restored-the-green-heart-of-seoul/cheonggyecheon-river-19/>



Figure 4.13: The termination of the constructed channel into a natural reserve.

Source: <http://inhabitat.com/how-the-cheonggyecheon-river-urban-design-restored-the-green-heart-of-seoul/cheonggyecheon-river-19/>

4.4.2

Los Angeles River Revitalization Master Plan, Los Angeles, CA

Project information:

Los Angeles River Revitalization Master Plan,
Los Angeles, CA
Completion date: 25-50 year blueprint for
implementing comprehensive
improvements
Client: City of Los Angeles, Bureau
of Engineering
Project team:
Landscape Architecture: Mia Lehrer + Associates
Team Project Manager: Tetra Tech, Inc.
Urban Design: Civitas, Inc.
Urban Design: HNTB Architecture, Inc.
River Corridor Planning: Wenk Associates

(Los Angeles River Revitalization Master Plan,
Los Angeles, CA 2009)

Background:

The Los Angeles River Revitalization project represents a successful cross-disciplinary approach to a dedicated 10 years of active participation. Its relevance to the author’s dissertation proposal is based on the project’s intentions of providing a new amenity, a source of socio-economic revitalisation, and a critical intervention for mitigating uncontrolled urban sprawl. These objectives would be achieved through the transformation of a 32 mile concrete lined conveyance channel into a significant ecological corridor within the urban realm (Los Angeles River Revitalization Master Plan 2009).

Project Development:

The project proposal, as an integrated approach to flood control, governance, natural systems and public open space that maximises the potential benefits, was the result of an extensive analysis of various existing infrastructural and ecological conditions of the corridor.

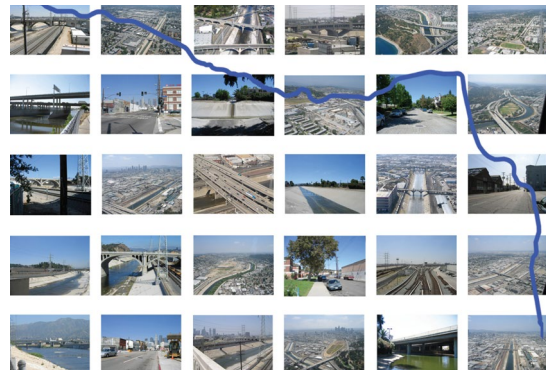


Figure 4.14: Infrastructure to be investigated in the LA Revitalisation project

Source: <http://www.asla.org/2009awards/064.html>



Figure 4.15: Community participation in the project proposal.

Source: <http://www.asla.org/2009awards/064.html>

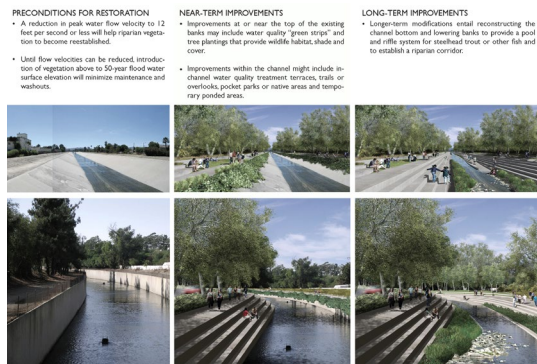


Figure 4.16: Proposals for the revitalised river areas.
Source: <http://www.asla.org/2009awards/064.html>

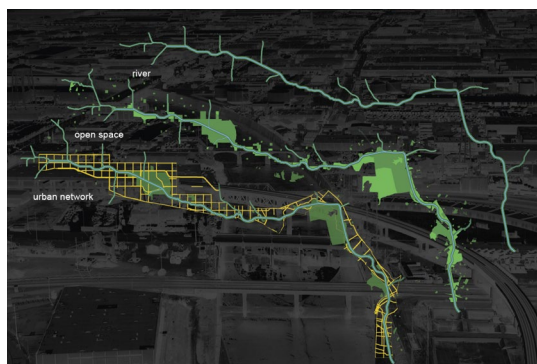


Figure 4.17: The networks and extent of the revitalisation project.
Source: <http://www.asla.org/2009awards/064.html>

As one of the few entities within the city that cross geographical, economic and social boundaries, the relationship between the river and its bordering communities offered the opportunity for public participation in developing the masterplans of 20 potential sites identified along the corridor.

Five basic principles as well as individual identified masterplans were emphasised during the conceptualisation of the river as ecological corridor. The five principles were outlined as the revitalization of the river, the ecological potential of integrating landscaped public spaces with the existing neighbourhoods, the exploitation of socio-economic opportunities of different communities, the addition of and emphasis on existing and significant values of the sites, the development of Community Planning Frameworks in order to better coordinate land-use development along the river, and finally creating a River Management Framework related to the river improvements, economic development and public space management of identified community sites (Los Angeles River Revitalization Master Plan 2009).



Figure 4.18: Vision for the Apies River Corridor. (Author 2015)

Between the city and the landscape:

Establishing a productive relationship within the **natural landscape and agricultural potential**.

Opportunities for diversifying multi-functional programmes with the **Educational facilities** within the precinct

Decentralised water treatment of the precinct to be naturally filtered before reusing or discharging into the river

Cultural Arena_

Social and ecological filtration point along the river corridor as most stimulated active node between the city centre and surrounding suburbs

Decentralised Grey and Stormwater harvesting and filtration to be reused on site. Buildings in the precinct or bordering the river channel should be integrated in the infrastructural reinvention.

Significant **recreational and historical** node to the river corridor.

Extension of the landscape into the city

The **natural landscape and water infrastructure** extends into the city through the Southern gateway of Pretoria

Naturalisation of the channel in Berea Park to enhance the recreational and pedestrian facilities within the residential community.

The recreational facilities should aim to establish a relationship beyond the residential community, to the **Unisa Sports facilities and the Transportation network** within the precinct.

Decentralised storm- and greywater treatment strategies to be implemented

4.5

Vision for the Apies River

Reinventing infrastructure towards a vision for the future Apies River Corridor would recognise the criticality of emphasising the biophilic qualities that the river offers, as well as employ strategies that exploit enjoyable, satisfying, inspiring and profitable environments for the public realm of the city. The emphasis on biophilic design should recognise the following three critical components: the urban and natural surroundings, the infrastructures that facilitate processes of the urban and natural realm, and the relationship between the two.

This project proposes a reinvention of the conveyance orientated, mono-functional infrastructure into a retention orientated approach of multi-functional systems that are rooted in the existing ecological and contextually relevant socio-cultural systems at proposed nodes along the corridor, as illustrated in Figure 4.17

The various decentralised nodes as proposed, aim to create a synthesis of new spatial compositions that brings together service infrastructure, the urban social landscape and the natural environment, towards reinscribing an identity onto the largely underutilised corridor that bisects the city of Pretoria. Hence the reimagined corridor becomes a network of a complimentary spectrum of events that operate within this urban caesura. Activated by an unpredictable assembly of everyday performances and natural systems, the dynamic nature of the various interventions should allow for maximum exploitation of its location, significance and infrastructure, generating multifunctional and multi-scale territorial networks that support the development of inclusive socio-cultural relationships.

The integration of architectural strategies with service infrastructure would allow the project's sphere of influence to extend beyond the precinct to an effective urban scale. By reimagining existing service infrastructure, instead of expanding on its capacity, the proposals

05

CHAPTER FIVE

CONTEXT: THIRD READING

INFRASTRUCTURE AT THE
SCALE OF THE SITE

Identifying the Site

Photographic Overview of the Site and Precinct

Site as a collection of isolated infrastructural systems

Micro scale analysis - Existing constituents of the site

Statement of Heritage Significance

Theory for the Site Vision

5.1

Identifying the Site

The chosen site has been identified as a collection of fragmented surplus sites adrift between the infrastructural edges of Nelson Mandela Drive and the Apies River Corridor. The site is hinged on its northern boundary to the historical Ceremonial Boulevard known as Stanza Bopape Street, as potential inception point of a collection of positive opportunities to be extracted and amplified between the city and surrounding suburbs. (See Figure 5.1)

The potential of the Apies River Corridor, and its relegation to an engineered concrete channel due to the demands of modernisation, has resulted in layers of water, built fabric, transport and energy infrastructure that presently dissect the site into rigidly controlled, isolated functions. This has resulted in the loss of its collective presence and significance in the city.

- The river's ecological resources and potential as well as its enigmatic and symbolic presence have been straightjacketed into a linear concrete entity.
- Its historical significance for the establishment and development of the city, as well as its significance as recreational entity has been rendered anonymous.
- Fragmented enclaves and impasses (deadlock urban situations) have diminished the potential of public spaces.

In their damaged state, these surplus marginal spaces offer new opportunities to be extracted and reimagined towards sustainable development of the inevitable densification of the city centre.

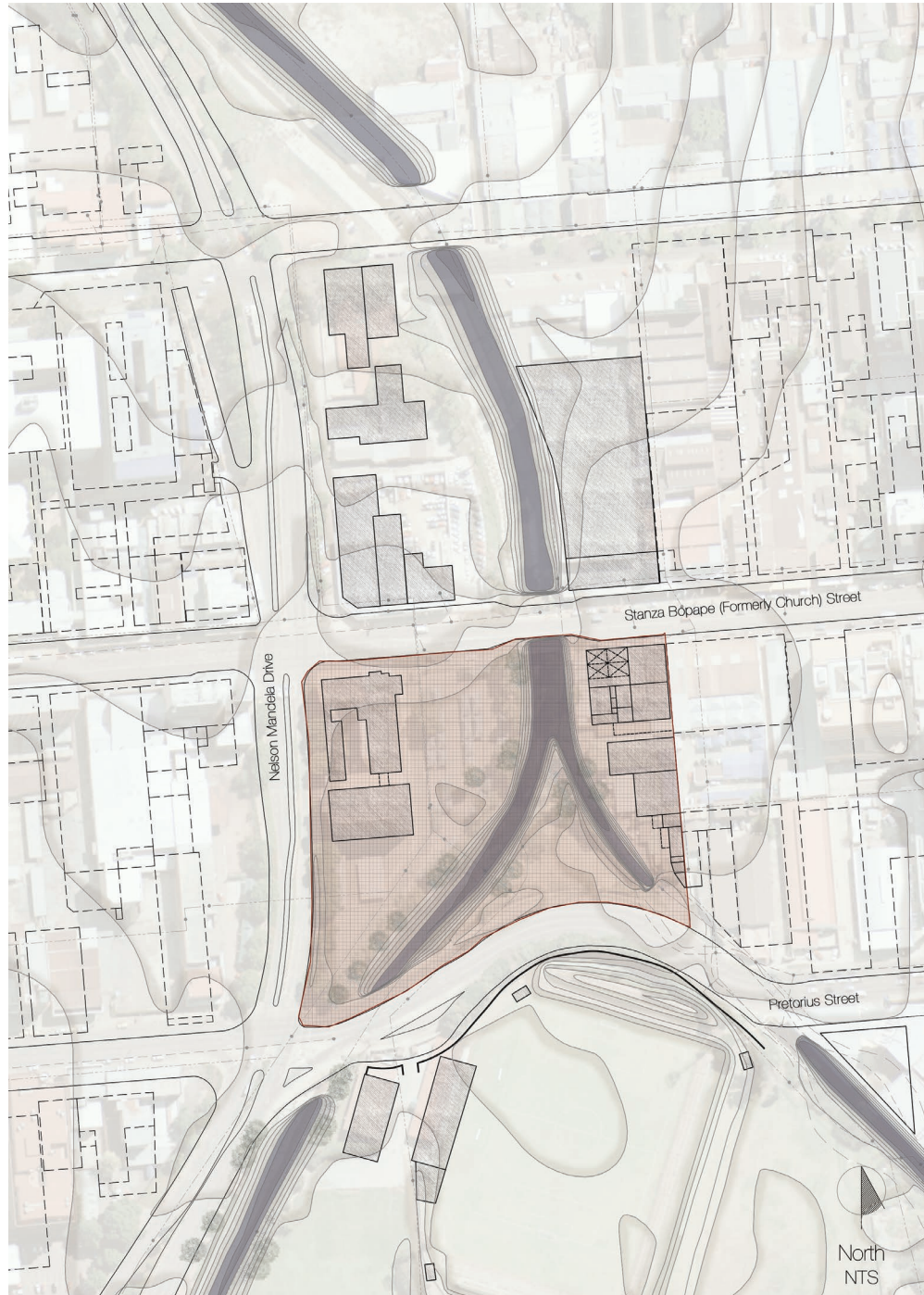


Figure 5.1: Locality map of the identified site

5.2

Photographic Overview of the Site and Precinct



Figure 5.2: Panoramic view from Stanza Bopape street towards the site, Lion Bridge and the confluence of the Apies River and Walker Spruit. (Photograph by Author 2015)



Figure 5.3: Panoramic view South down the Apies River Stormwater channel, looking towards the Eastern suspended site. (Photograph by author 2015)





Figure 5.4: Panoramic view North towards Stanza Bopape street from the proposed project site. towards the site and Lion Bridge (Photograph by Author 2015)



Figure 5.5: Panoramic view from Stanza Bopape street towards the site, Lion Bridge and the confluence of the Apies River and Walker Spruit. (Photograph by Author 2015)



Figure 5.6: Panoramic view from Stanza Bopape street towards the site, Lion Bridge and the confluence of the Apies River and Walker Spruit. (Photograph by Author 2015)



Figure 5.7: Panoramic view from Pretorius Street onwards the site. (Photograph by Author 2015)



5.3

The Site as a Collection of Isolated Infrastructural Systems

More recently, there has been an increased interest in the architectural discourse regarding ecological awareness and the production of public space in infrastructure design. The author is in agreement with Meyboom (2009:76) that architects (including landscape architects) are well positioned to coordinate a cross-disciplinary approach to constructing a successful multi-faceted infrastructural project. The insights and interests regarding such multi-faceted infrastructural projects should aim to go beyond the limitations of economics and efficiencies.

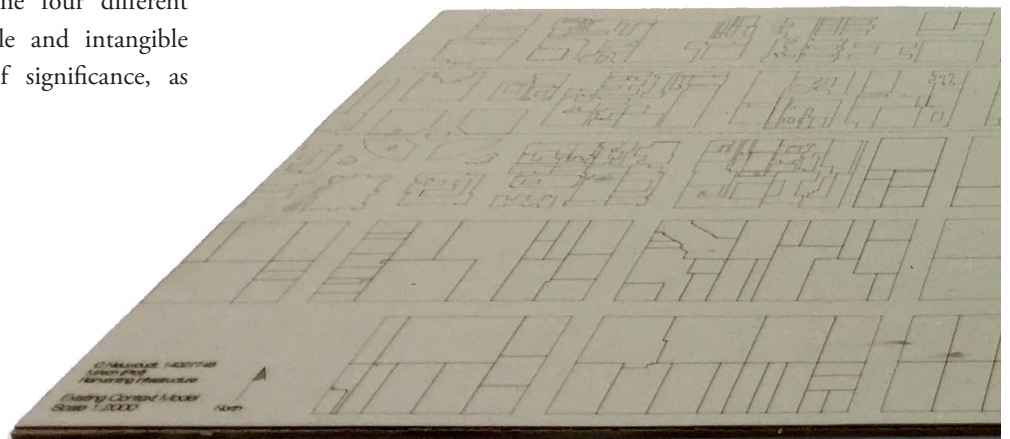
The architectural relationship between structure and space is stimulated by the sectional arrangement of the existing layered infrastructure. The success and potential of public space therefore relies on the equal consideration for and integration of both infrastructural form and its direct and indirect service to its spatial and socio-economic purposes.

Ecosystemic thinking and implementation in the planning of cities and sites, according to Ken Yeang (2009), are achieved through an integrated, dynamic living system that is designed to be functional as well as responsive. A system should encourage a symbiotic relationship between all four infrastructural frameworks facilitating human activity – frameworks categorised as ecological infrastructure (green), water infrastructure (blue), transport infrastructure (grey) and social infrastructure (red). The investigation at the scale of the precinct examines the transformation of the site's infrastructural networks according to the four different frameworks and their respective tangible and intangible heritage significances in a hierarchy of significance, as discussed in the four following categories.

An alternative approach towards an ecosystemic infrastructure requires the integration and therefore investigation and comprehension of these various existing and presently isolated infrastructural realms as identified. The design should aim to provide a platform / structure that encourages alternative and spontaneous spatial conditions to emerge from interaction between the designed and the indeterminate future appropriations and occurrences.

In Meyboom's article "Infrastructure as Practice" (2009:76), Foreign Office Architects state, "There is no difference between making a city and making a building or a detail." Meyboom further argues the inclusion of infrastructure in this statement and declares that the design thereof should be approached with techniques that investigate unconventional ways of appropriation, the historical significance of the place, and the physical interaction of infrastructure with activities, in addition to the environment as a space both for recreation and a resource to be maintained (2009:77).

For infrastructure construction it may be an unfamiliar alternative investigation, and yet for architecture it simply becomes an exploration at various scales and with a diverse programmatic content.



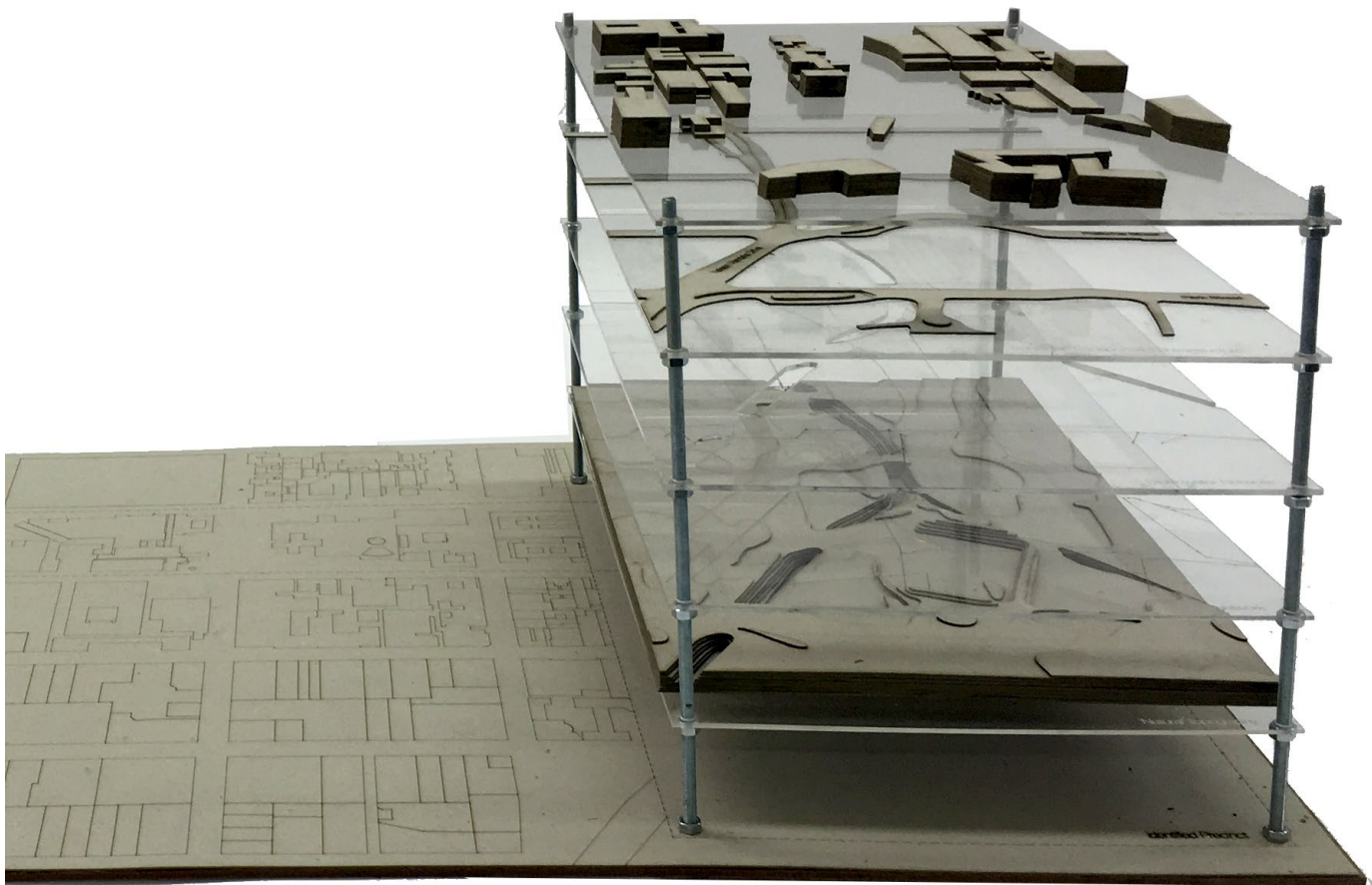


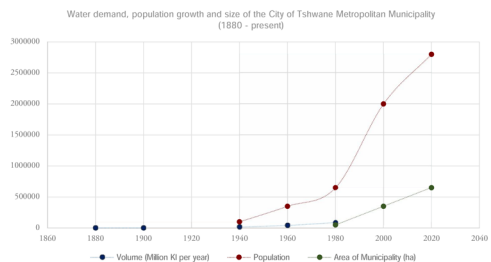
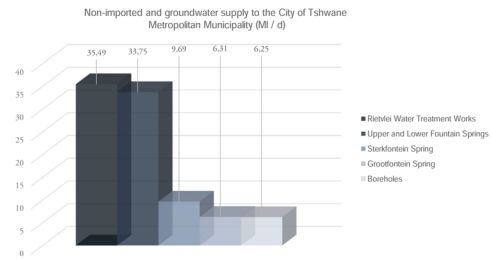
Figure 5.8: Existing Isolated networks of infrastructural systems within the site. (Author 2015)

5.3.1 Water Infrastructure

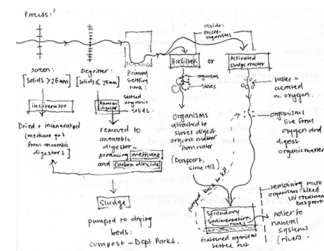
The water and ecological infrastructures are regarded as most significant in structuring an integrated approach, as these mediate between the systems of the site and the broader city networks.

The water infrastructure in essence manages a sustainable approach to all water related potentials and constraints of the site, and includes the insurance that surface water run-off remains on site and ground water is replenished where possible, as well as the protection of and emphasis on the significance of water within the built environment and its context. This includes comprehending existing stormwater, rainwater, surface run-off and sewerage conditions as well as their larger spheres of influence within the precinct, in order to reimagine alternative strategies of harvesting, storage, filtration and conveyance of this precious and limited resource.

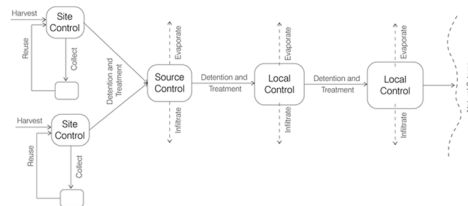
The tangible and intangible heritage significance includes the concrete water channels conveying stormwater run-off and, as indicated on the map (See Figure 5.10), the remembrance of Pretoria's first water mill built on the western bank of the Apies River in 1875 and later demolished during the course of the development of the city.



Existing wastewater treatment process:



Proposed decentralised treatment network:



Water calculations based on existing site conditions:

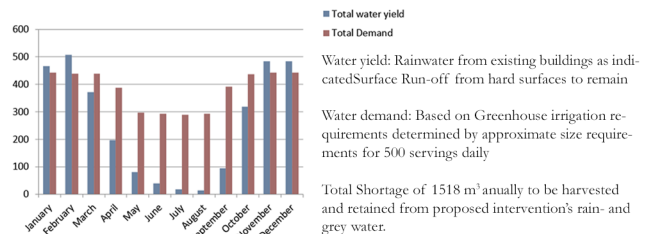


Figure 5.9: Summary of the investigation of Water systems of the Apies River and greater City of Tshwane Metropolitan Municipality
Source: Dippenaar, M, . Geology Department, University of Pretoria, South Africa , www.up.ac.za/geology

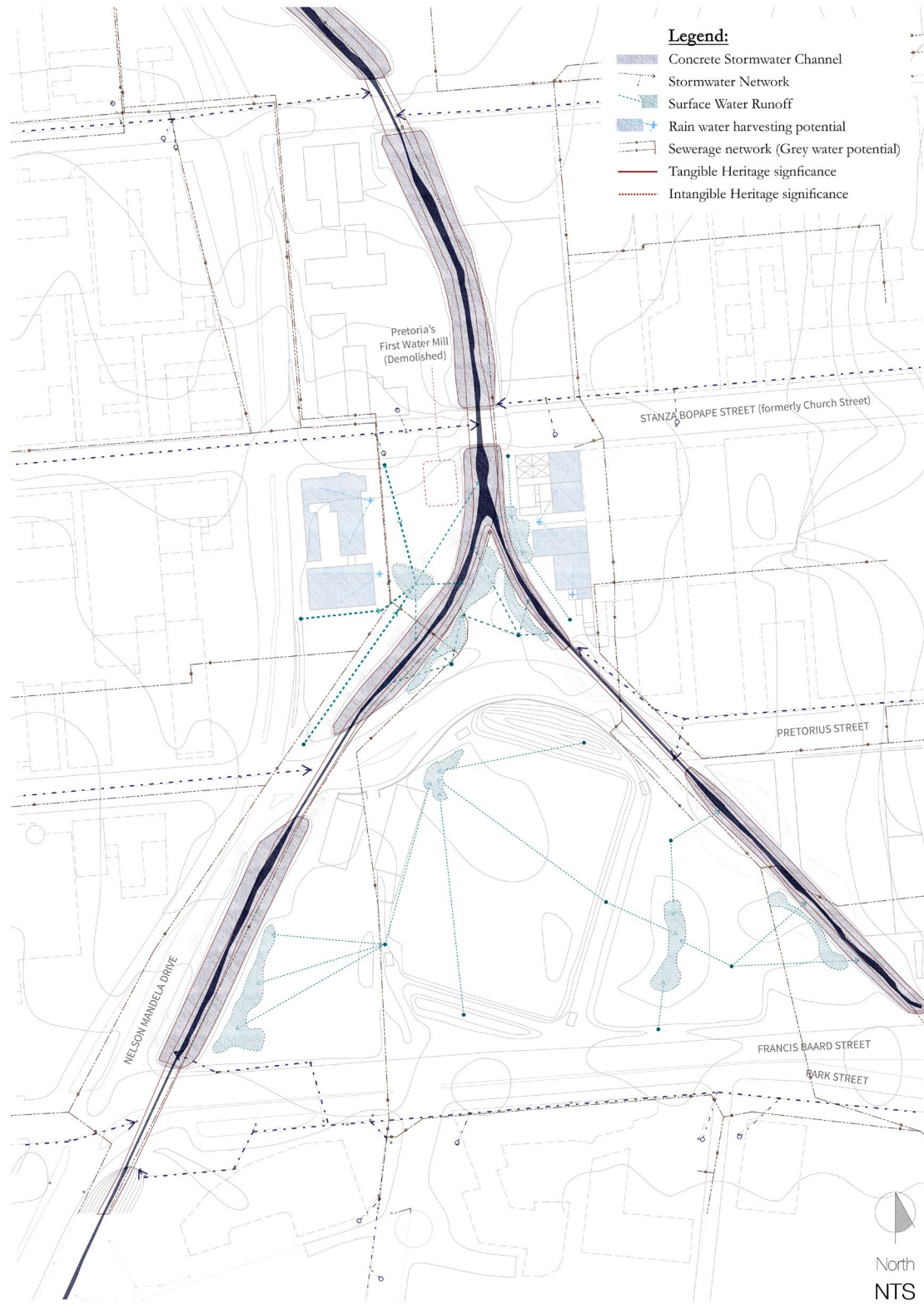


Figure 5.10: Synthesised map illustrating the combined water processes within the precinct and site. (Author 2015)

5.3.2

Ecological Infrastructure

The ecological infrastructure is a network of interrelated natural systems and open spaces on the site, which includes existing contours and topography, naturally vegetated spaces, artificial landscaped spaces and ‘undeveloped natural spaces’ (See Figure 5.11 and Figure 5.12 – ecological maps). Its tangible and intangible heritage significance, as indicated, includes the historical date palm trees planted along the banks of the Apies River during 1912, depicted in many artists’ representations of the landscape such as Pieter Wenning’s “Canalization of the Apies River”

The qualitative information substantiating the spatial presentations includes species of vegetation identified along the river channels and their significance, the geology and soil types of the primary river catchment area, as well as a shadow analysis of the site identifying possible areas with productive ecological potential.

Through understanding and proposing alternative strategies for reinventing existing ecological infrastructure, emphasis on the management of natural potential and characteristics present on the site would enable the conservation of the relationship between the urban and ecological environments. To maintain a continuity of these systems, especially across hardscape surfaces, the proposed infrastructure can be designed to bridge the barriers through what Yeang describes as ‘ecobridges’ or ‘eco-undercrofts’. The benefits of the presence and utilisation of ecological infrastructure and its integration with development frameworks include carbon sinks, pollution control, flood prevention, natural cooling and biodiversity enhancement.



Orange Honeysuckle (*Lonicera ciliosa*)
Plant Type : Shrub
non-indigenous species from Northern America
Woodland (35-60% cover)
Light Requirements: Sun, Partial Shade
Attracts Wildlife : Hummingbirds, Butterflies, Bees



English Ivy (*Hedera helix*)
Plant Type : Ground cover - perennial, Climbing - Perennial
Exotic to South Africa
Requires Average Water
Light Requirements: Full sun or full shade
Attracts Wildlife : Birds



Foxtail Buffalo Grass (*Cenchrus ciliaris*)
Plant Type : Ground cover - Grass
Native to South Africa and many other African countries
Requires Average Water
Light Requirements: Full sun
Attracts Wildlife : Variety of animals attracted for feeding



Table Mountain Fern (*Blechnum tabulare*)
Plant Type : Erect - Perennials, Fern
Indigenous to South Africa
Likes dampness
Light Requirements: Full or partial shade
Attracts Wildlife : Variety of animals attracted for feeding



Crane Flower (*Strelitzia Reginae*)
Plant Type : Erect - Perennial flowering plant
Indigenous to South Africa
Likes dampness
Light Requirements: Full rich sun
Attracts Wildlife : Known to attract Squirrels



Mountain Saffron (*Scolopia mundii*)
Plant Type : Medium to tall tree
Indigenous to South Africa
Likes dampness
Light Requirements: Well suited to the interior or margins of a forest community
Attracts Wildlife : Known to attract various birds



Jacaranda (*Jacaranda mimosifolia*)
Plant Type : Medium to tall tree
Invasive to South Africa
Dense stands along watercourses
Light Requirements: Full sun
Attracts Wildlife : Attracts bees and squirrels



Wild Fig (*Ficus thonningii*)
Plant Type : Small to Medium tree
Originating from Southern Africa
Strangler, eliminates surrounding trees or shrubs by strangler their roots
Light Requirements: Full to medium sun
Attracts Wildlife : Attracts birds



Pomegranate tree (*Punica granatum*)
Plant Type : Small to Medium tree
Non Indigenous
Pomegranate fruit in season form March to May
Light Requirements: Full to medium sun
Attracts Wildlife : Attracts birds and other animals



Acacia Tree (*Acacia galpinii*)
Plant Type : Large to tall tree
Originating from southern africa
Normally found near streams
Light Requirements: Full to medium sun
Attracts Wildlife : Many insects such as bees and wasps visit the flowers



Wild Date Palm (*Phoenix reclinata*)
Plant Type : Large to tall Palm
Found across Africa
Produces a small date fruit
Light Requirements: Full to medium sun
Attracts Wildlife : Attracts birds and other animals

Figure 5.11: Vegetation identified along the banks of the Apies River channel. (Author 2015)

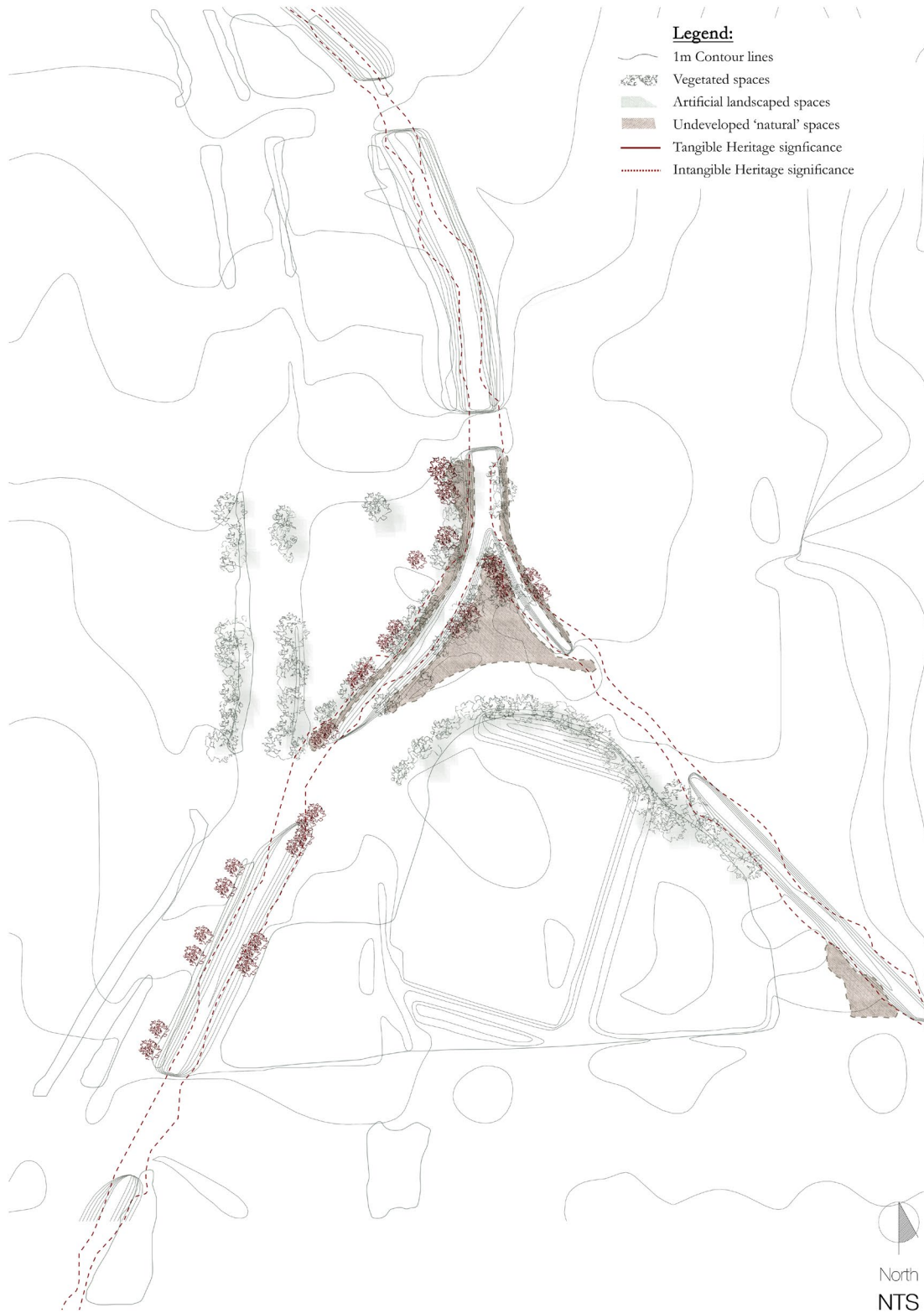


Figure 5.12: Synthesised map illustrating the combined ecological existence within the precinct and site. (Author 2015)

5.3.3

Social Infrastructure

The social infrastructure includes all infrastructure facilitating cultural practices such as existing built forms, recreational spaces, pedestrian networks, important access and gathering points on site, as well as economic and informal social networks. The investigation represents the building uses within the precinct as well as the conditions surrounding the site, polarised by the surrounding building uses and physical fabric (See Figure 5.15). Ecosystemic infrastructure integrates the social with the water, ecological and transportation infrastructures, establishing a relationship between the cultural and natural realms of the urban landscape.

Insurgent spatial practices such as public bathing and sleeping occurs in concealed areas of the site such as the river channel, stormwater drainage pipes and densely vegetated spaces, inaccessible and hidden from the public realm. (See 5.2 Photographic Overview of the Site and Precinct)

The tangible heritage significance within the precinct includes heritage structures indicated such as the Emmanuel Christian Church building adjacent to the Caledonian Sports Field, as well as the club house, the flood light structures and the stone boundary wall of the sports field. (See Figure 5.13 and 5.14)

The intangible heritage within the precinct includes the demolished Central Public Swimming Pools, redeveloped as a government precinct, as well as the historical Ceremonial Boulevard on Stanza Bopape Street which, as Church Street, has been the scene of various marches in the country's history. Its regeneration within the Re Kgabisa Tshwane Inner City Development Project includes landmarks such as Heroes' Acres, Kruger House, Church Square, the Palace of Justice, Ou Raadsaal, Lilian Ngoyi Square, the State Theatre, the Reserve Bank, the Caledonian Sports Field and Union Buildings to support a future pedestrianisation strategy at critical points, as proposed.



Figure 5.13: Historic curved stone boundary wall and floodlight structure of the Caledonian Sports Grounds. (Photograph by author 2015)



Figure 5.14: Photograph of the heritage pavilion structure at the Caledonian Sports Grounds. (Photograph by author)

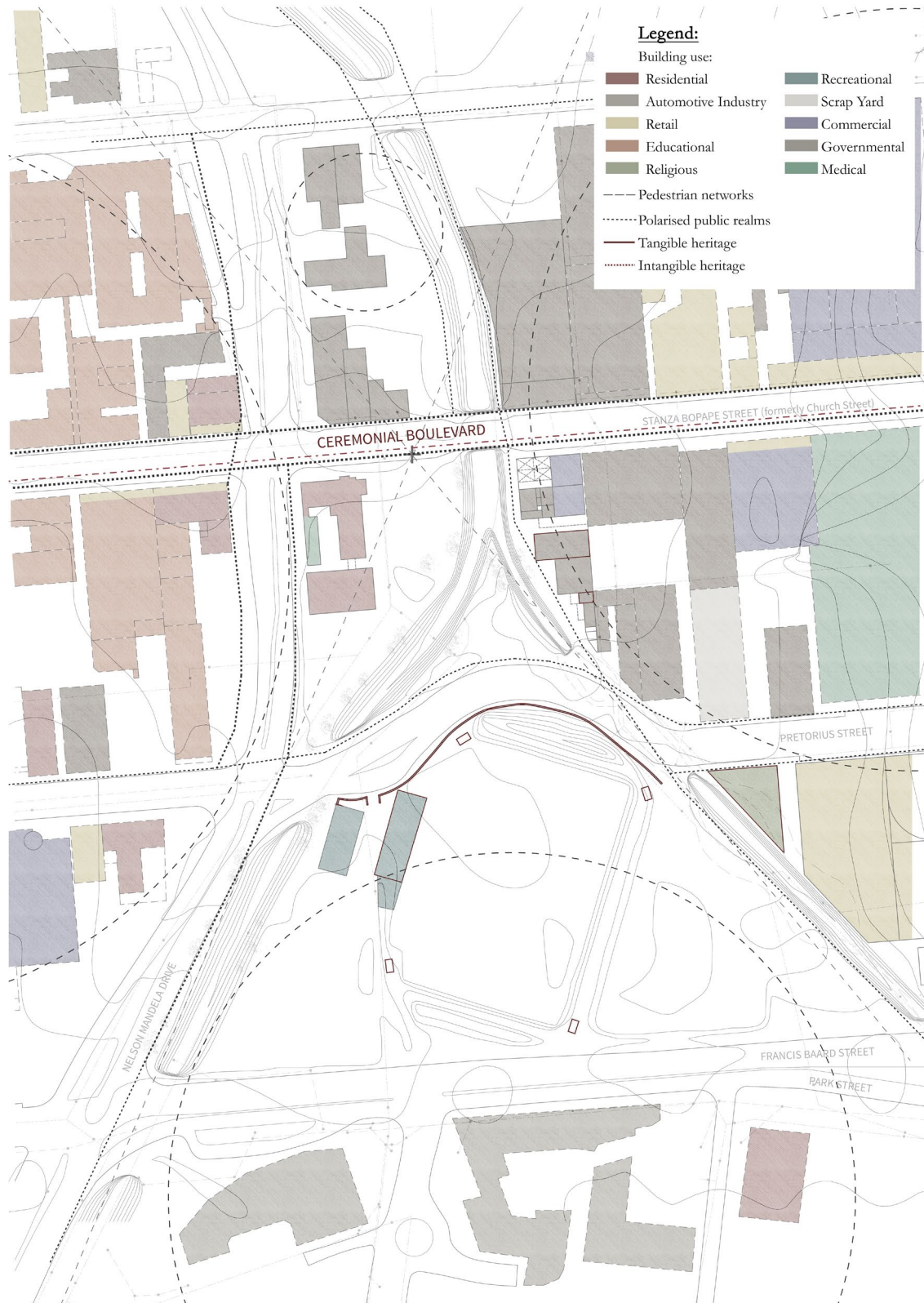


Figure 5.15: Synthesised map illustrating the combined social infrastructure within the precinct and site. (Author 2015)

6.3.4

Transportation Infrastructure

According to the Yeang's infrastructural categorisation, the grey infrastructure comprises of all the large urban engineering systems essential to the support and effective operation of any human urban development, including roads, telecommunications and energy structures, such as street lighting. The contextual analysis of the dissertation precinct however delimits the investigation to transportation infrastructure as it is the only significant engineering system present within the precinct. All other infrastructural services within this category are therefore excluded and the topic from here on referred to transportation, instead of engineering infrastructure. (Ken Yeang: Ecomasterplanning 2009)

The transportation networks investigated includes the vehicular networks, Tshwane Bus stops, informal taxi gathering nodes and parking spaces within the precinct. (See Figure 6.17)

The tangible heritage significance within the precinct as indicated includes Lion Bridge, reconstructed in 1887 and discussed in chapter 4.2 First collective reading of the city, 5.2 Timeline: Transformation of the Apies River Identity as well as 6.3 Statement of Heritage Significance . (See Figure 6.16 – Lion Bridge)

The intangible heritage significance as indicated includes the commemoration of the trajectory of old Edward Street, presently demolished as well as the previously linear Pretorius Street, removed and reinstated in a curvilinear trajectory due to the form and positioning of the Caledonian Sports Fields.

An Ecosystemic infrastructural approach to transportation requires a reinvention of public opportunities that is ecologically responsive and integrated with other frameworks. In our present condition, the implementation of these urban systems are dominated by economics and convenience, modifying the site's existing topography, involving extensive earthworks. An ecosystemic approach to infrastructural implementation aims to avoid such land alterations by appropriating the proposed infrastructural implementations within existing topographical conditions and constraints, working with the potential opportunities and improving constraints of existing movement and access conditions. Thus avoiding substantial modifications to the existing topography, topsoil removal, soil erosion and pollution of watercourses.



Figure 5.16: The historic Lion Bridge on Stanza Bopape Street, crossing the Apies River channel. (Photograph by author 2015)

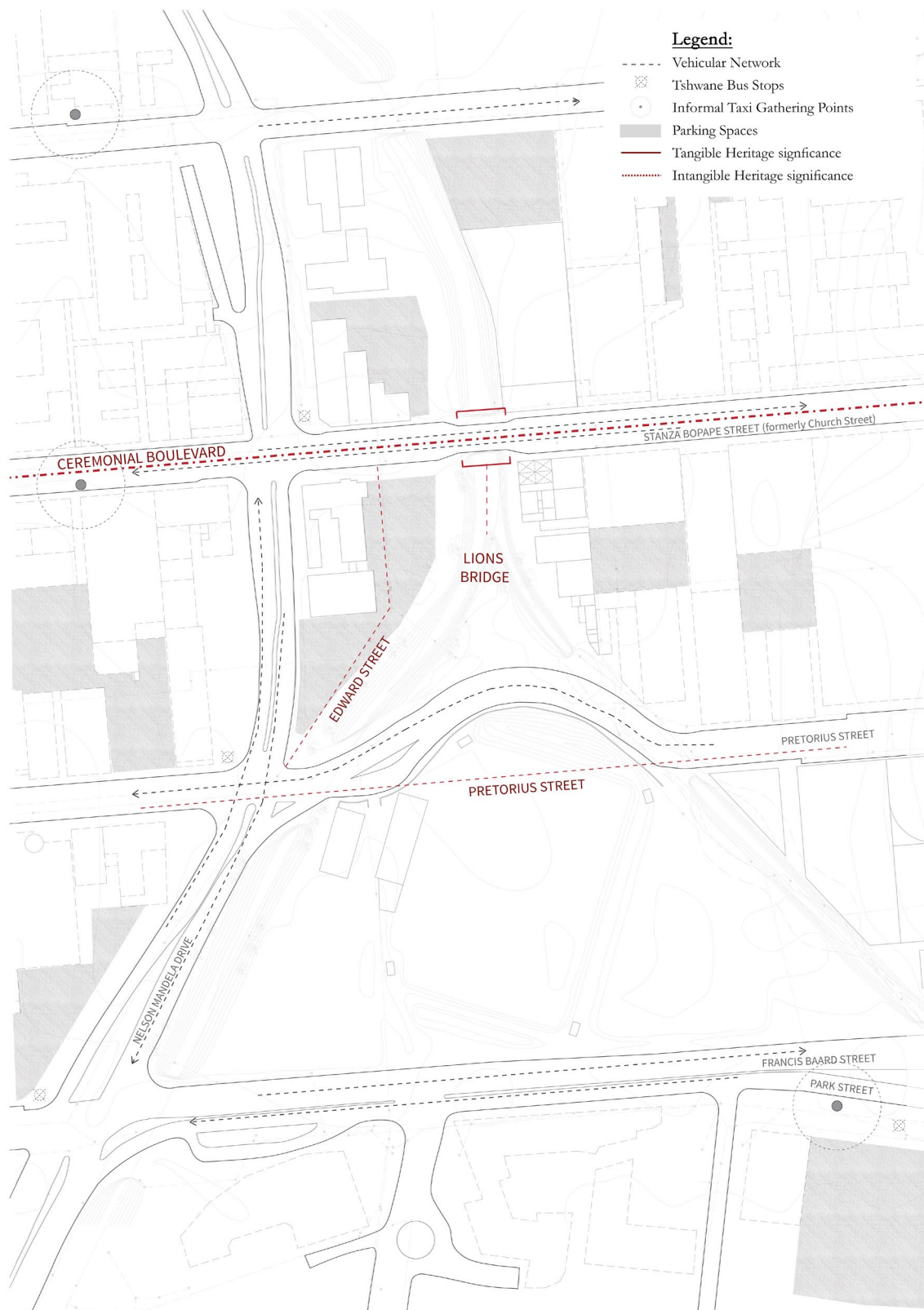
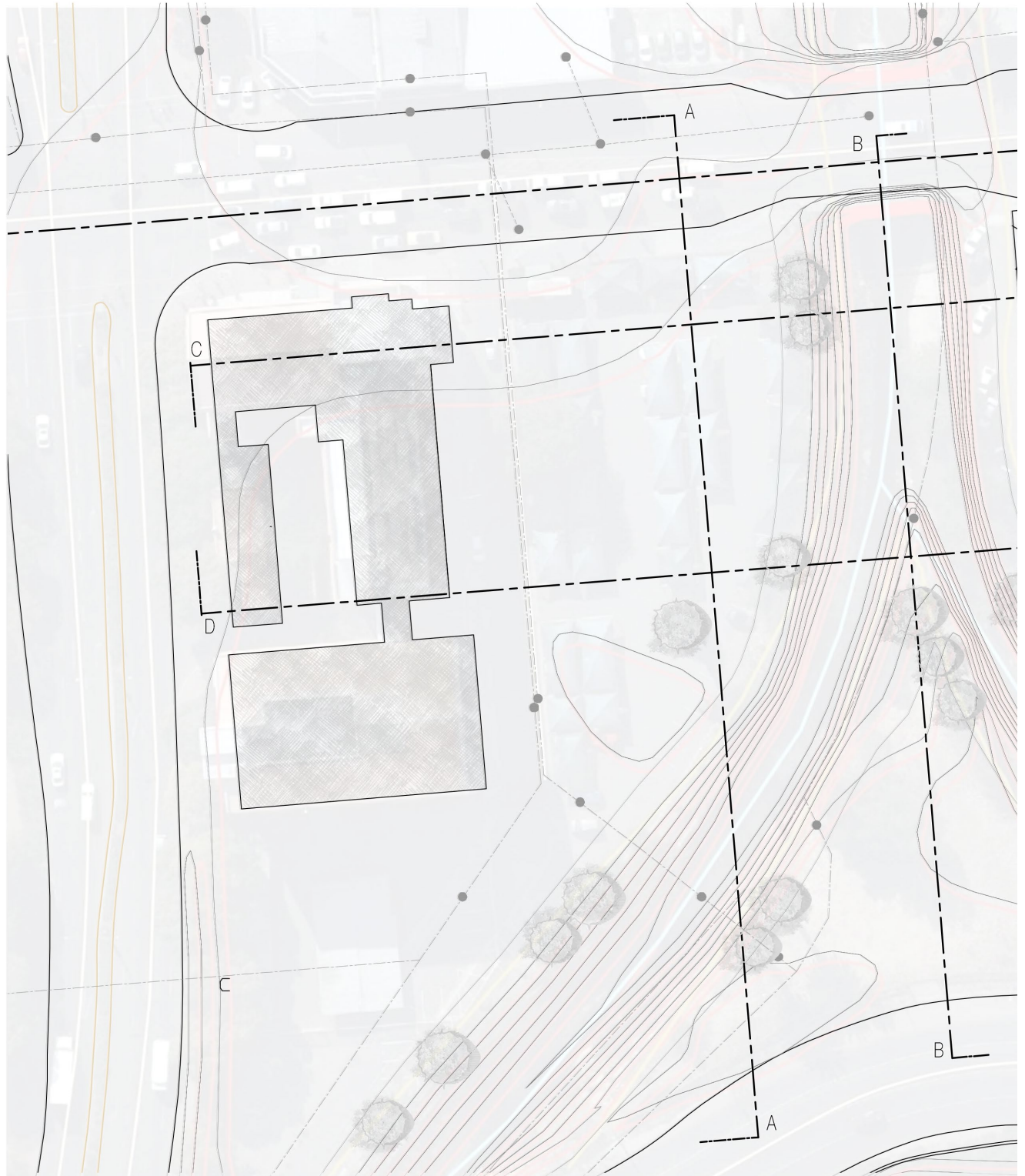


Figure 5.17: Synthesised map illustrating the combined transportation infrastructure within the precinct and site. (Author 2015)

5.4

Micro scale analysis - Existing constituents of the site



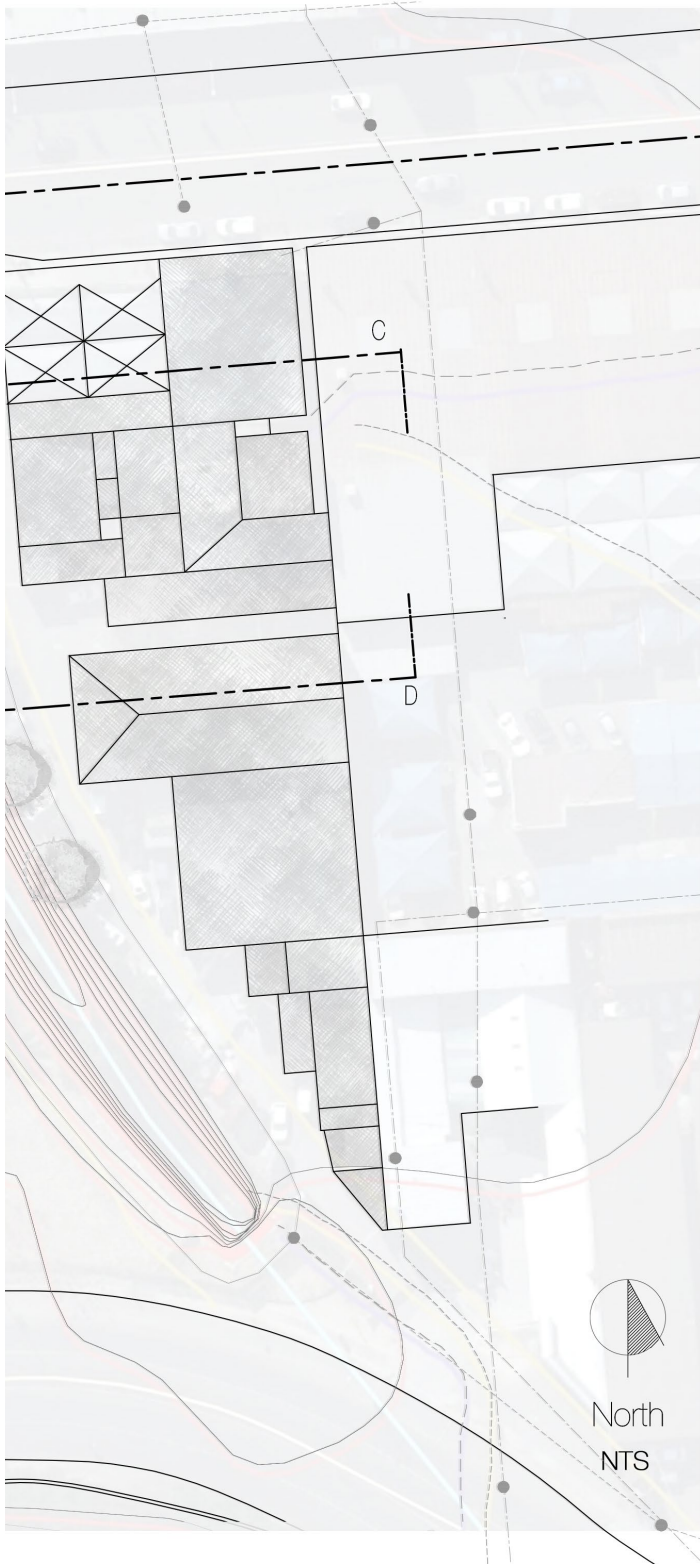
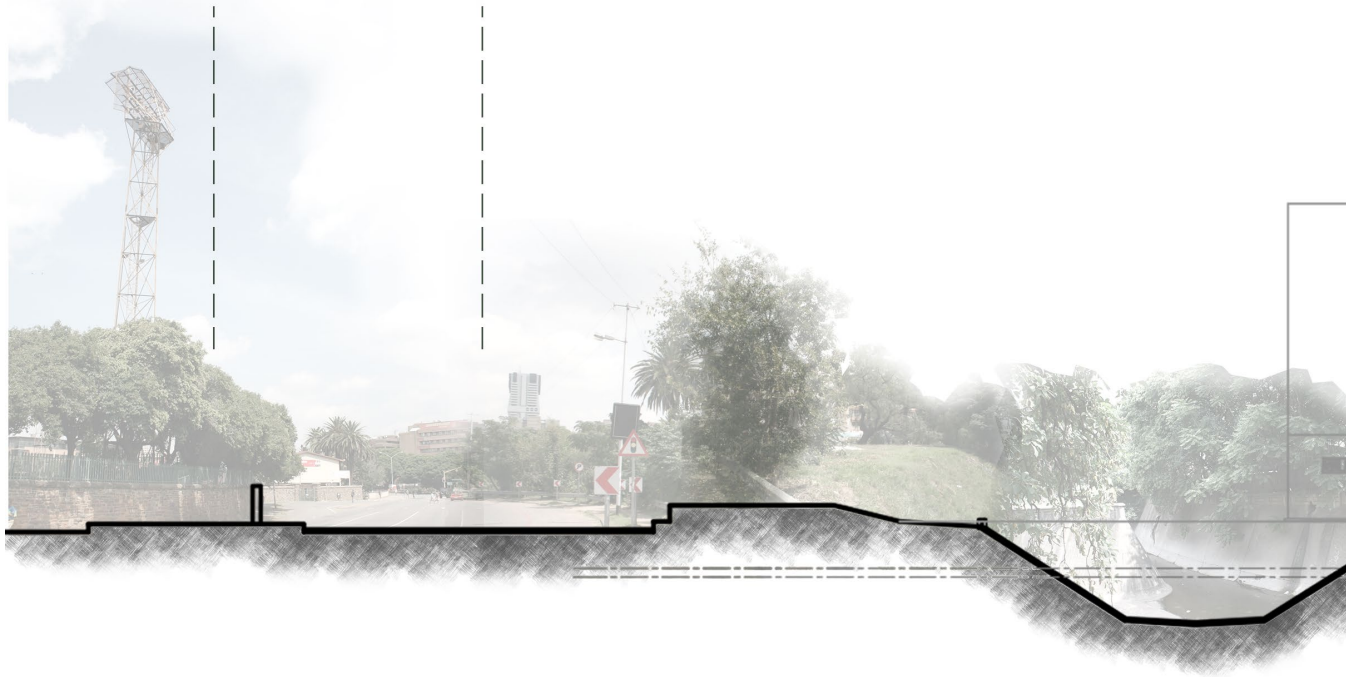


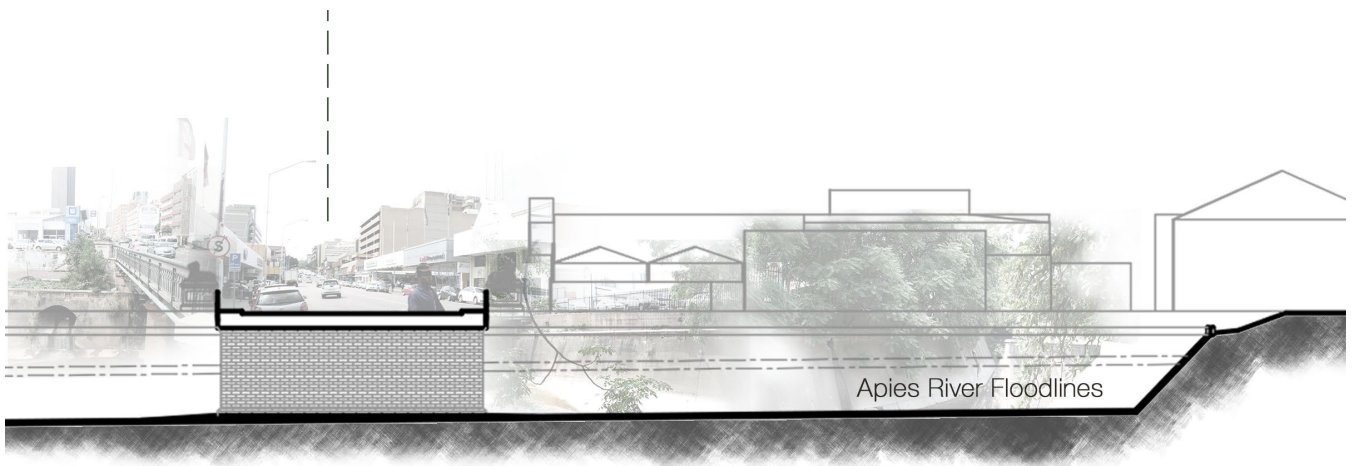
Figure 5.18: Existing Plan of the site including floodlines, sewage networks, stormwater networks and the positions of the historical Date Palm trees to be retained on site. (Author 2015)

Caledonian
Sports Fields

Pretorius Street



Stanza Bopape Street
Ceremonial Boulevard



Leos Place
Student Accommodation

Stanza Bopape Street
Ceremonial Boulevard

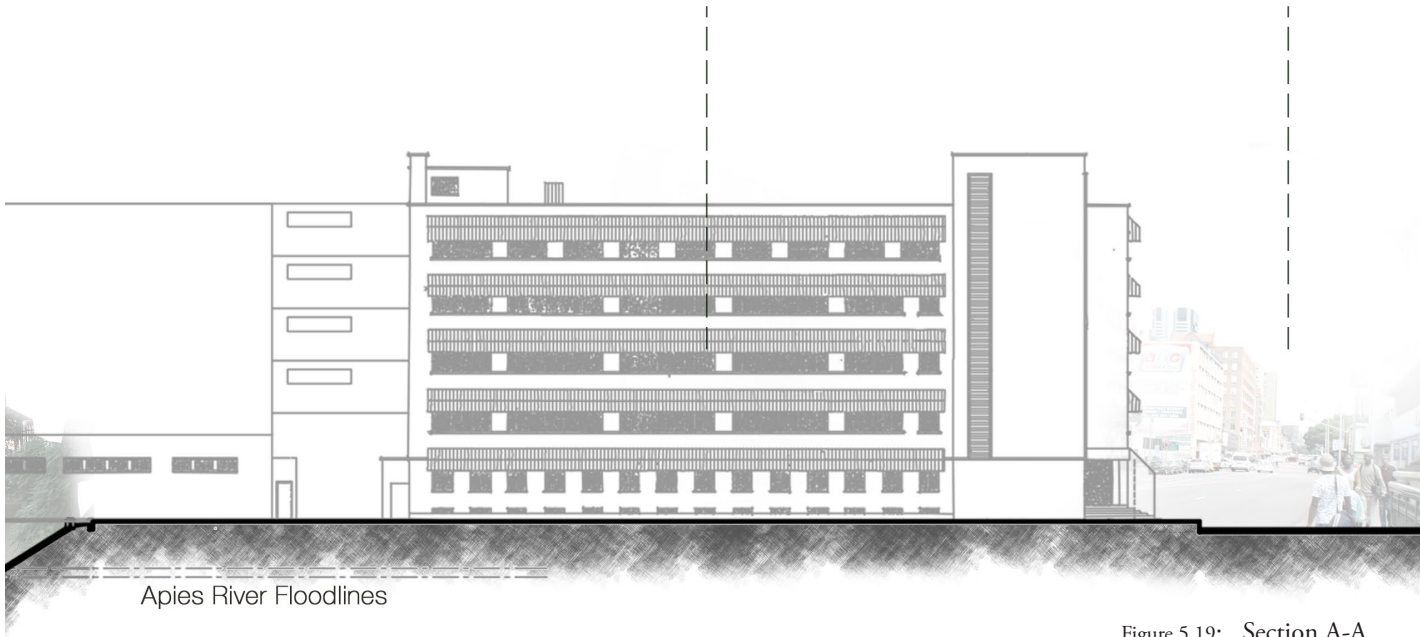


Figure 5.19: Section A-A
NTS

Informal Vehicle
Mechanic Workshop

Pretorius Street

Caledonian
Sports Fields

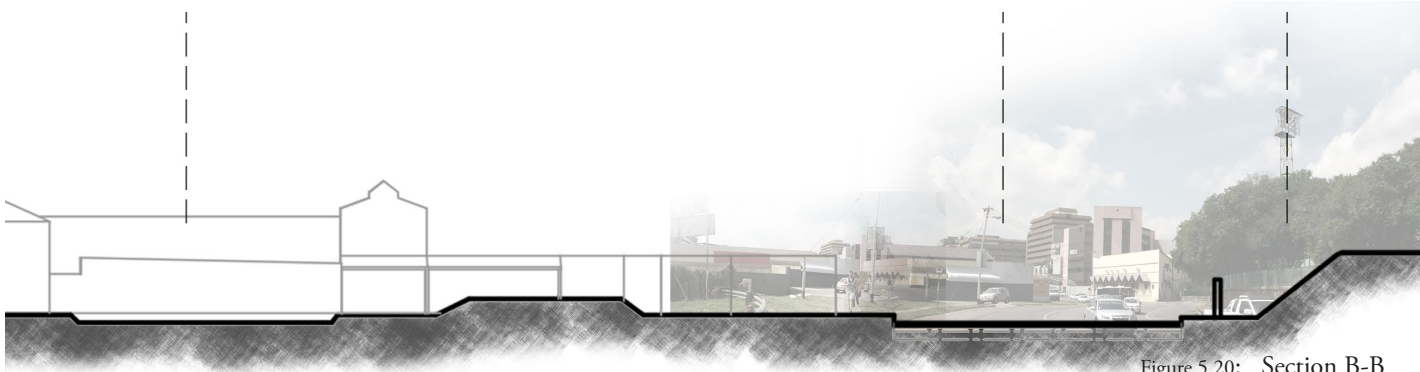
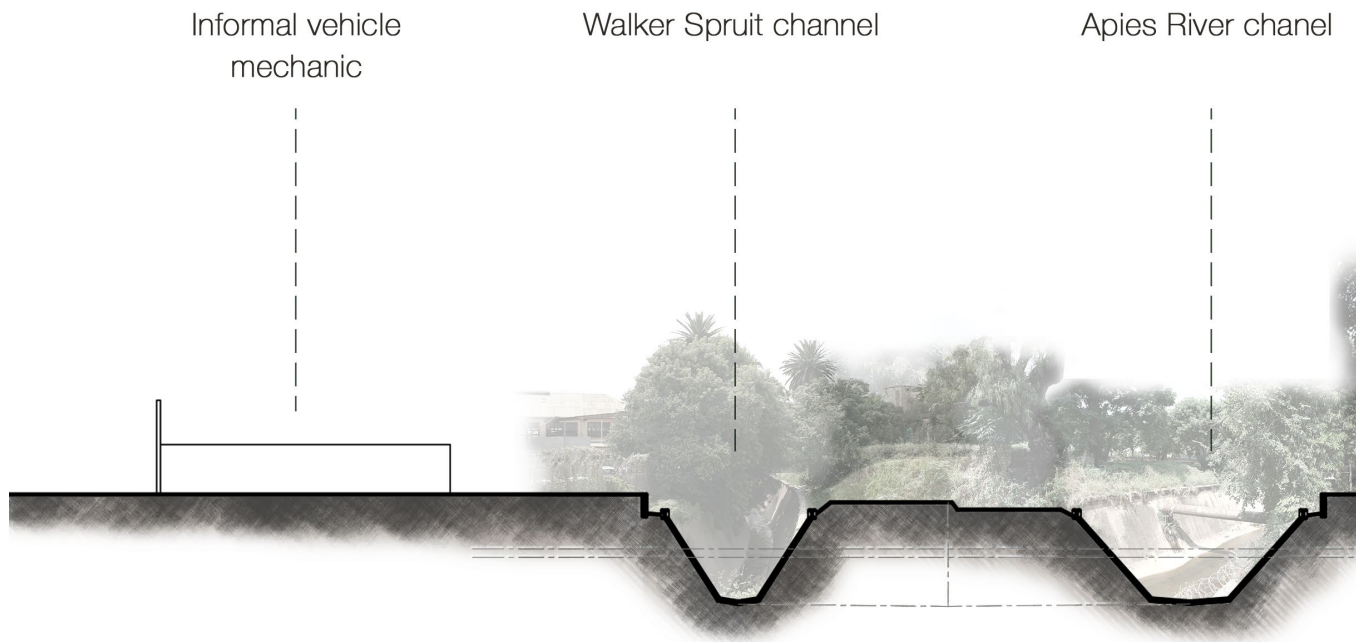
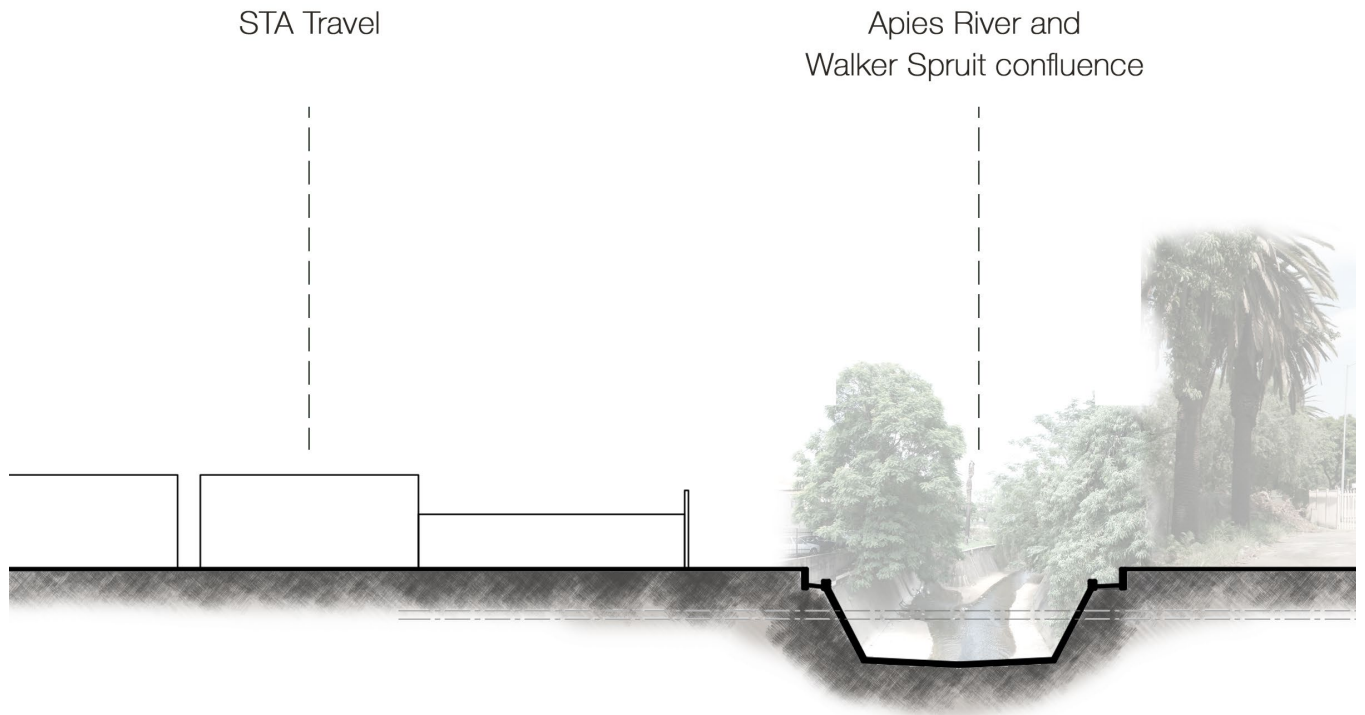


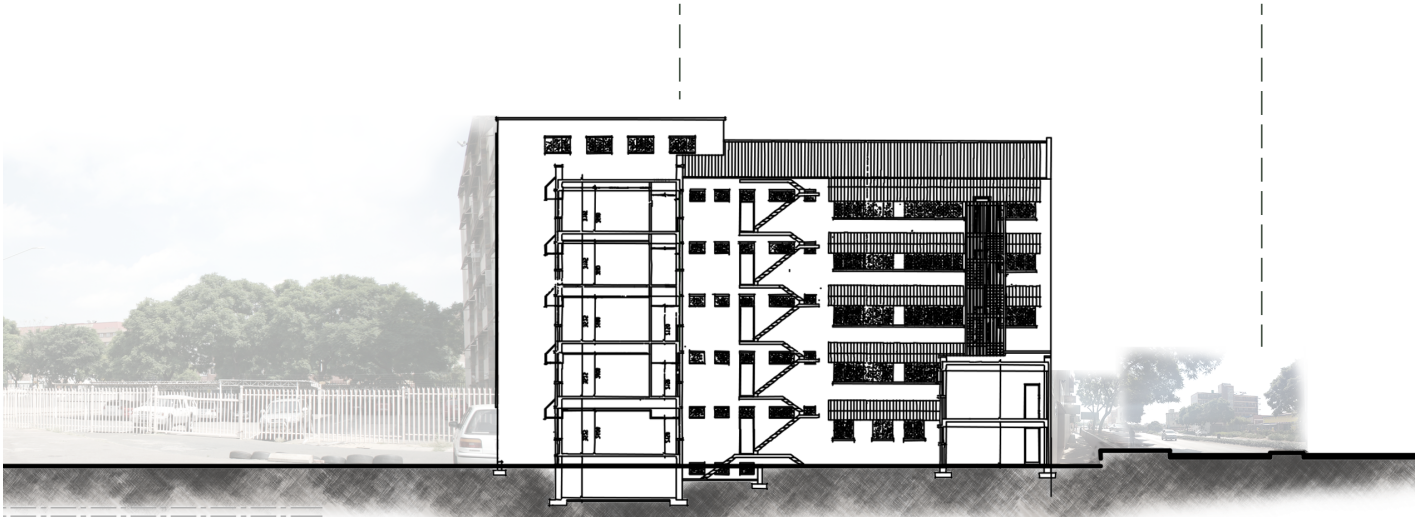
Figure 5.20: Section B-B
NTS

Existing Sections through the site



Leos Place
Student Accommodation

Nelson
Mandela Drive

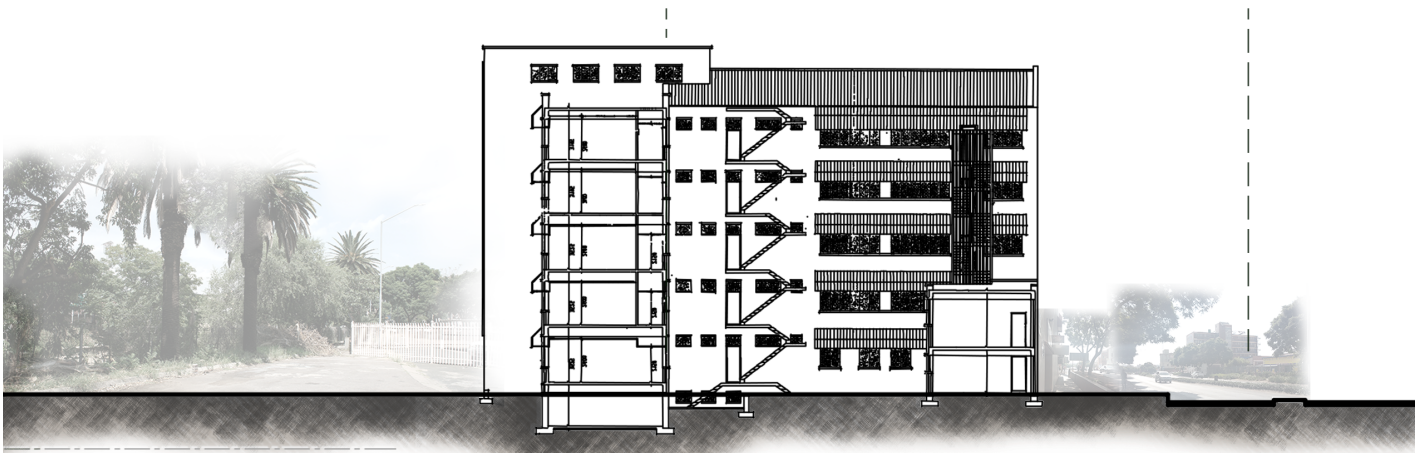


Apies River Floodlines

Figure 5.21: Section C-C
NTS

Leos Place
Student Accommodation

Nelson
Mandela Drive



Apies River Floodlines

Figure 5.22: Section D-D
NTS

Existing Sections through the site

Statement of Heritage Significance

The motivation for the conservation of cultural significance, as stated in the International Council on Monuments and Sites (ICOMOS) Burra Charter, is the importance of providing a deep and inspirational sense of connection to community and landscape, to its past and to lived experiences (International Council on Monuments and Sites 2013:1). These represent a manifestation of important characteristics of identity and experience. The identified values could be categorised as aesthetic, historic, scientific, social and spiritual. The Burra Charter therefore encourages a well-considered approach to change and argues that any intervention be considered to: do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained (International Council on Monuments and Sites 2013:1).

The Apies River Corridor and project precinct contribute a considerable amount of cultural significance, including aesthetic, historic, social and spiritual values, to the city of Pretoria. The Apies River and its former natural presence within the city as significant source for the establishment of the town, is presently expressed by the course of the concrete-lined stormwater channel covering the majority of its expanse throughout the city, symbolising the cultural advancements of urbanisation and industrialisation of water infrastructure in urban areas.

At the crossing of Church Street and the Apies River, the construction of the Arcadia Bridge in 1888 replaced what was formerly known as Meintjiesdrift. However, due to the construction method and the strength of the stream during heavy rainfall periods throughout the summer months, the Arcadia Bridge was soon to be replaced by Lion Bridge, the construction of which was completed in 1894. This structure of importance, designed by S.W. Wierda and decorated with symbolic bronze lion figures on pedestals, reinforces the significance of Church Street as main axis between the town centre and surrounding suburbs. This important historical and cultural artefact should be conserved yet celebrated in any proposed design interventions through an emphasis on its location, and its historic and aesthetic values.

The ecologically significant vegetated areas along the channel edges that include the historic date palms planted in 1912, provide an important aesthetic and recreational aspect as visual landmark of orientation in the city, as depicted in various artists' representations and discussed in Chapter 6.2.2_Ecological Infrastructure. The aesthetic and ecological values of these channel edges, as well as important views along them to noteworthy bridges, should be retained and celebrated in any new interventions.

The historical Ceremonial Boulevard on Stanza Bopape Street becomes an important contributor to the celebration of heritage significance throughout the site. The proposal for a future pedestrianisation strategy at critical points along this boulevard, as published in the Re Kgabisa Tshwane Inner City Development Project, becomes a fundamental consideration in the project's architectural relationship to the northern boundary of the site. Architecturally, programmatically and visually, this boundary of the proposed intervention should be exploited to establish a celebratory emphasis on the various culturally significant elements and characteristics of the site as identified and discussed in the previous paragraphs.

The southern boundary of the site on Pretorius Street borders the Caledonian Sports Fields, recognised for its recreational significance in the city. The Pretoria Regional Style Clubhouse, the stone boundary walls and the steel floodlight structures are all of noteworthy historical significance. The importance of this recreational entity to various cultural groups, as substantiated through a number of personal accounts and published records, should be preserved.

It is the author's belief that the use of the site is however to be diversified to emphasise this significance and activate it more sustainably – as discussed in Article 1 item 1.9 of the Burra Charter, which defines adaptation as changing a place to suit the existing use or a proposed use (International Council on Monuments and Sites 2013:2) in order to conserve its cultural significance.

The architectural intent is to create a project that supports the cultural significance of the area and starts to inform an appropriate design response.

The architectural position for the revitalization of the identified sites is aimed at the re-interpretation and re-activation of the current unfeasible use value through:

- determining opportunity for necessary change and implementing a conservative approach to the redevelopment of the significant tangible and intangible elements such as the concrete channels and Lion Bridge itself.
- making required additions that are sensitively considered, yet expressive and identifiable through a distinct separation between confident interventions and existing fabric, with the boundary to be developed to facilitate a comprehensive dialogue. The separation created should be an expression of difference rather than dissonance. New work should be adaptable to change, as required by the development, without diminishing existing ascribed value.



Figure 5.23: Historic curved stone boundary wall and floodlight structure of the Caledonian Sports Grounds. (Photograph by author 2015)



Figure 5.24: Photograph of the heritage pavilion structure at the Caledonian Sports Grounds. (Photograph by author)

Figure 5.25: The historic Lion Bridge on Stanza Bopape Street, crossing the Apies River channel. (Photograph by author 2015)

5.6

Theory for the Site Vision

5.6.1

Towards Ecosystemic Infrastructure

Historically, infrastructural projects such as bridges and railways were acknowledged as heroic achievements expressing the progressive identity of cities, and were celebrated as such. Today however, the urban landscape has evolved into a collection of dense urban centres surrounded by sprawling peripheral suburbs. Currently, the construction of infrastructure is no longer considered as heroic or momentous, but is concerned with the provision of an additional layer or extension of a ubiquitous infrastructural system. Its existence is mostly utilitarian and, apart from addressing more recent ecological concerns, its implementation is subject to the provision of control, convenience, economic efficiency and exploitation of resources, as layers of networks connecting decentralised concentrations of developments (Meyboom 2009:73).

Regardless of its necessity, the physical nature of the present infrastructure of the Apies River demonstrates a barrier to interaction across its boundaries, and contributes to the deterioration of the physical and social conditions of its surroundings, due to its lack of significance, place and ownership.

The present condition of infrastructure in the city, as previously discussed in the general theoretical premise and in the investigation of the transformation of the Apies River landscape specifically, has led to the implementation of isolated, mono-functional, engineered infrastructural systems that have consequentially fragmented adjacent public spaces that have become impracticable for public utilisation and discourage spontaneous activities and modes of movement.

The rapid increase in population and urbanisation, leading to an increased demand for infrastructural support, can no longer be provided for by simply adding to or extending the capacity of existing networks, further encouraging isolated linear water systems and neglecting the reality of current water concerns. An alternative reinvention of existing infrastructure is required that would integrate and exploit the various potentials of this essential life source.

The potential of infrastructure within the city could be exploited to produce a generative response that creates place through the utilisation of its multi-faceted opportunities, as well as a directive response that supports progressive future development.

An alternative ecosystemic approach to infrastructure, with an emphasis on the production of public space and socio-economic opportunities as primary generators of a formal and spatial response, could encourage the integration of innovative, responsive elements with the existing infrastructures, subsequently generating a multiplicity of networks, functions and places as well as providing for future potential development (Meyboom 2009:72). Such a strategy should aim to stimulate a symbiotic relationship between the non-living and living entities identified on site, enriching the existing ecological composition and structures and thus establishing a more sustainable approach to an artificially constructed environment that resembles nature's ecosystemic processes.

06

CHAPTER SIX

DESIGN INFORMANTS

.....
SYNTHESISING EXISTING INFRASTRUCTURE
AND FORMULATING AN ARCHITECTURAL
INTENTION FOR THE DESIGN DEVELOPMENT

Introduction

Contextual Informants

Conceptual Informants

Programmatic Informants

Precedent Studies

6.1
Introduction

The Architectural Hypothesis states that a city’s unique identity is collectively influenced by both the natural and cultural processes that are constructed in our cultural developments into habitable artificial environments. By reimagining existing infrastructure through a proposed architectural intervention, it enables the potential to construct a symbiotic relationship that acknowledges non-human natural systems as agents, and also acknowledges the constraints of human practices; therefore the following research questions can be posed:

- How can dehumanised infrastructural complexes be reinvented in a symbiotic relationship with ecological and socio-cultural existence?
- How can a newly established architectural identity, through the exploitation of infrastructure and resources its scale, language, accessibility and edge conditions establish an intangible dialogue with the polarised conditions of the city centre and residential areas?
- How can an infrastructural reinvention of an adaptable recreational and socio-economic typology, through a discharge into its context, amplify the positive opportunities in and significance of the spatially fragmented Apies River 'island' as 'other space' between city and suburb?

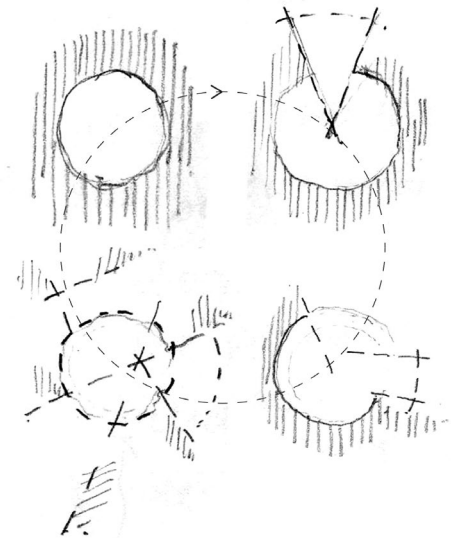
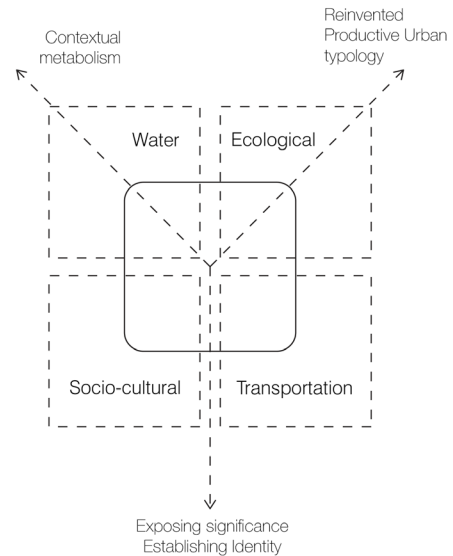


Figure 6.1: Dormant potential of the ecological processes to be exploited through a continual architectural reinvention as contextual metabolism. (Author 2015)

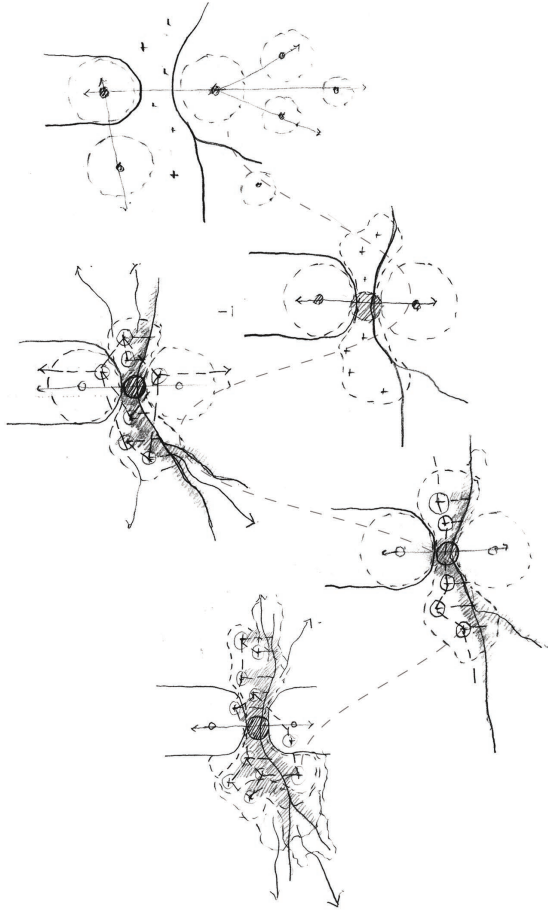


Figure 6.2: Extracting opportunities
Exposing the significance of the site and infrastructural
opportunities. (Author 2015)

The method of structuring a response to the design process was directed by three main informants to iteratively formulate a synthesised conceptual approach to the design development, as outlined in the following chapter.

The first informant, the contextual conditions, synthesises the infrastructural investigations from the scale of the city to the scale of the site, towards exploiting potential opportunities of integrating and activating the existing conditions through an architectural intervention.

The second informant, the conceptual approach, is founded in the theoretical premise of reconstructing the realm of the existing artificial environment as an integrated domain founded in both nature and culture.

Finally, the programme as cultural urban arena that responds to the contextual and conceptual informants, is unpacked. Various opportunities for recreational and socio-economic appropriations are investigated to encourage continuous urban scenarios of public engagement that exploit the numerous ecological potentials of the river and the existing landscape.

Precedent studies, as inspired by the three main informants, are investigated to construct a synthesised architectural intention for the design development as presented and discussed in the final section of this chapter.

6.2

Contextual Informants

The contextual informants for structuring an architectural intention for the design development of the building are explored through a graphical investigation as a response to the existing conditions of the surrounding precinct – as elaborated in the illustrations and their discussion to follow.

Actual Territories' constitute the city's built negative, the interstitial and the marginal, spaces abandoned or in the process of transformation. These are the removed lieu de la memoirs, the unconscious becoming of the urban systems, the spaces of confrontation and contamination between the organic and the inorganic, between nature and artifice. Here the metabolization of humanity's discarded scrap, or nature's detritus, produces a new horizon of unexplored territories, mutant and by default virgin, that are for Stalker 'Actual Territories'. The term 'actual' indicates the process in which space comes into being. The 'actual' is not what we are, but rather that we are becoming, that is to say the 'other' that becomes other.

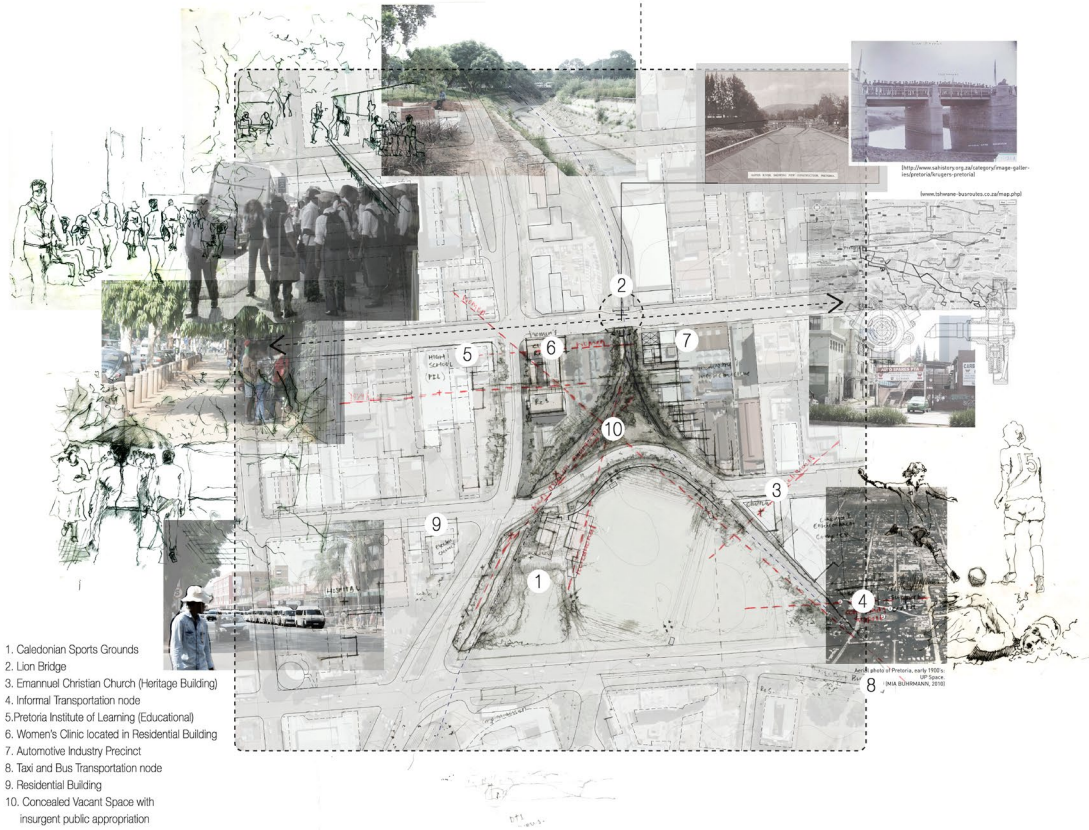
Stalker in (Lang 2008:222)



Figure 6.3: Illustrates the initial intuitive contextual response to the site and its formal and spatial conditions during a concept development workshop. Model constructed by workshop colleague Marie Oberholzer, through a discussion on the contextual conditions between the author and the workshop colleague.



- Significant Landmarks:
1. Church Square
 2. Sammy Marks Square
 3. Lilien Ngoyi Square
 4. State Theatre
 5. South African Reserve Bank
 6. Caledonian Sports Fields
 7. Union Buildings



1. Caledonian Sports Grounds
2. Lion Bridge
3. Emmanuel Christian Church (Heritage Building)
4. Informal Transportation node
5. Pretoria Institute of Learning (Educational)
6. Women's Clinic located in Residential Building
7. Automotive Industry Precinct
8. Taxi and Bus Transportation node
9. Residential Building
10. Concoaled Vacant Space with insurgent public appropriation

Figure 6.4 locates the site within the identified city framework and vision for the river, while simultaneously illustrating the significant contextual activities observed during an experiential walkabout through the precinct. (Author 2015)

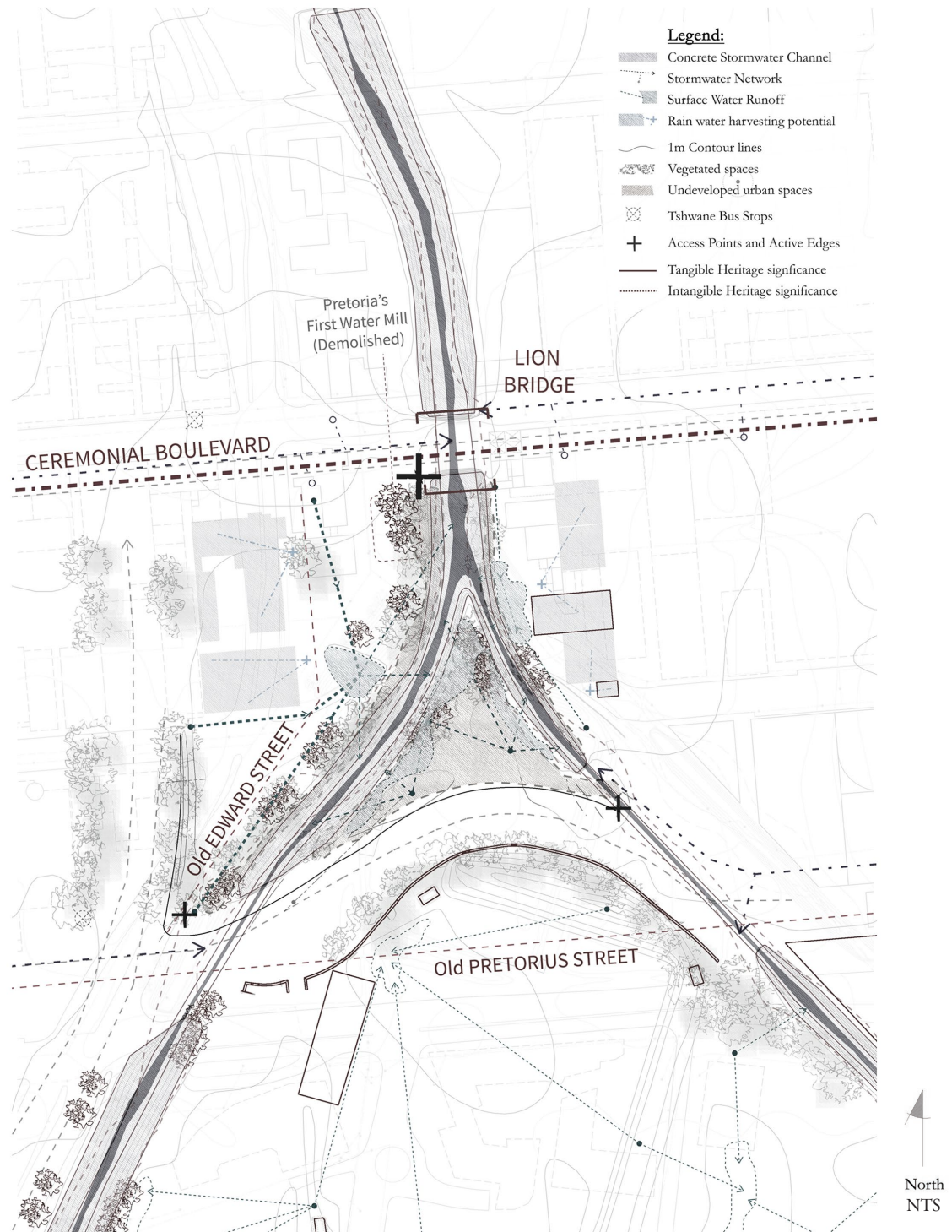


Figure 6.5 illustrates an extraction of the main contextual informants from the existing infrastructural maps discussed in Chapter 6: Infrastructure at the Scale of the Site, and synthesises it into a collective map that emphasises the opportunities for intervention and gives a guiding background to the conceptual informants. (Author 2015)

6.3

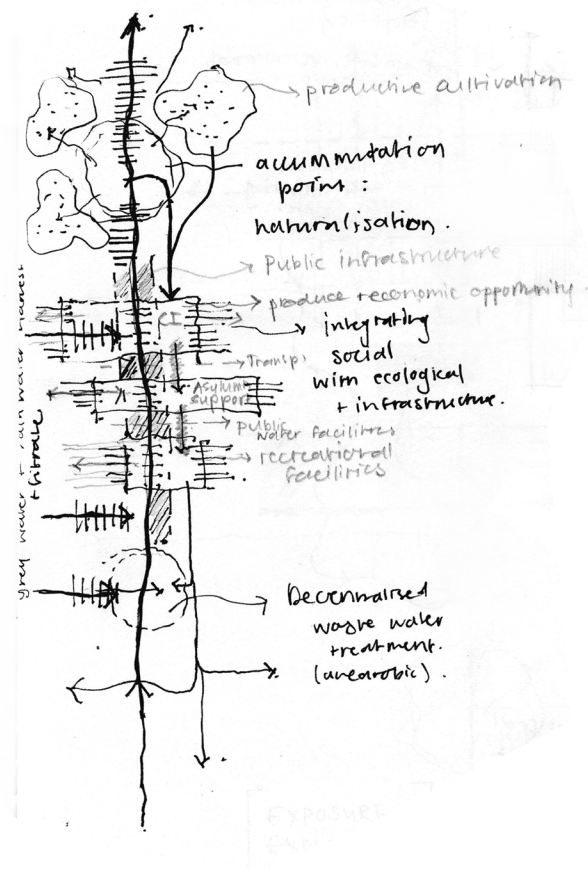
Conceptual Informants

Developed from both theoretical and contextual investigations for the project, the conceptual informants focus on the recreation of an artificial landscape through the reinvention of existing and proposed infrastructure as generator of public space and recreational and socio-economic opportunities.

The recreation of this artificial landscape is addressed through a double-ended approach of sculpting the landscape and natural processes, while simultaneously appropriating or developing a structural response to contextual and conceptual informants, in order to identify points of integration for the activation of infrastructure as generator of public space and recreational and socio-economic opportunities.

By reimagining existing infrastructure as part of the production of form and space, the marginalised urban voids are regained for innovative design interventions, alternative occupation, and a new public appropriation that connects the city to the water. The proposed intervention aims to become an architectural filter as an extension of the existing infrastructure of the urban realm, Stanza Bopape Street and the regenerated Apies River Island, that:

- contains and activates the potential of the recreational landscape;
- offers new public space through a relationship between Stanza Bopape Street and the river;
- increases the area's ecological contribution through reinscribing an identity;
- amplifies its historical and cultural significance through a relationship between the proposed interventions and historical remnants surrounding the site;
- capitalises on the spatial, material, and socio-economic possibilities of infrastructure; and
- provides an enigmatic experience beyond its infrastructural use.



The architectural intervention will seek to address the reality of the consequential disenfranchised spaces, while simultaneously challenging the architectural intervention itself as alternative strategy that allows for a diverse range of adaptive appropriations, in order to prevent the perpetuation of static consequences in future transformations.

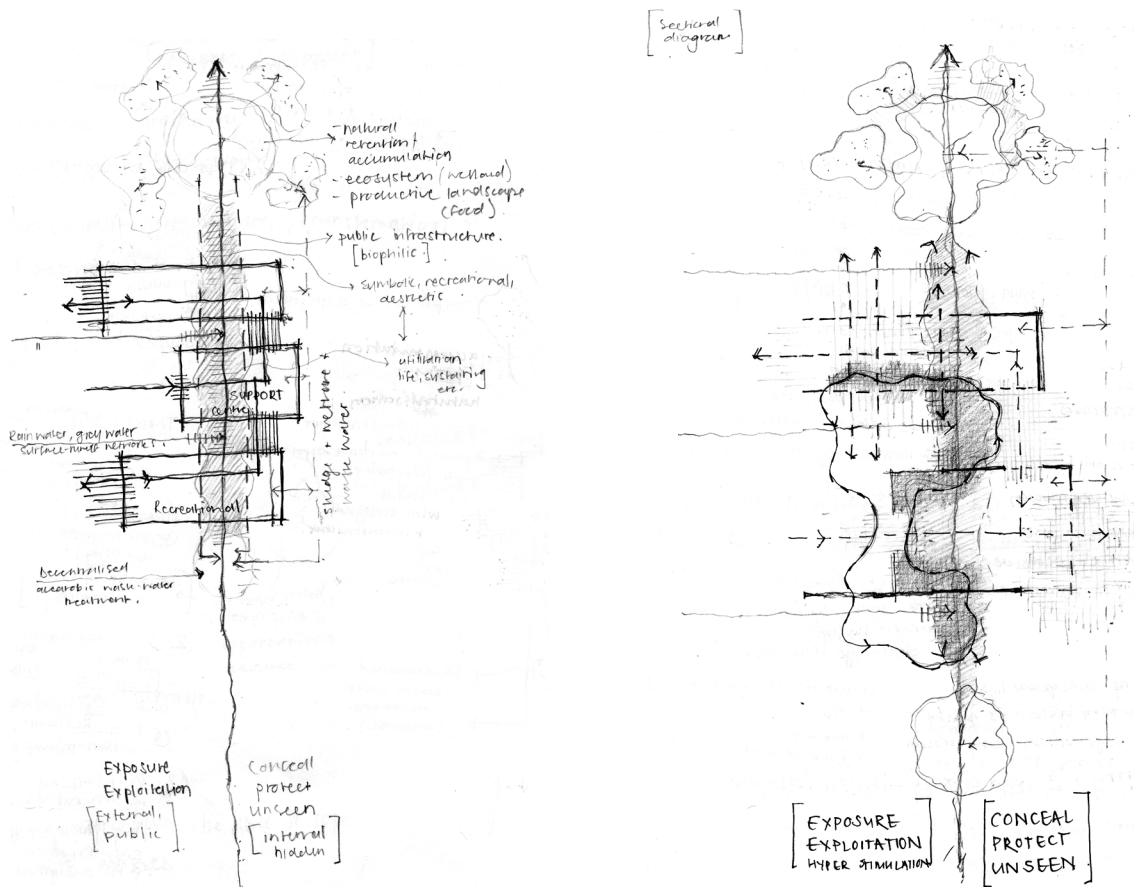
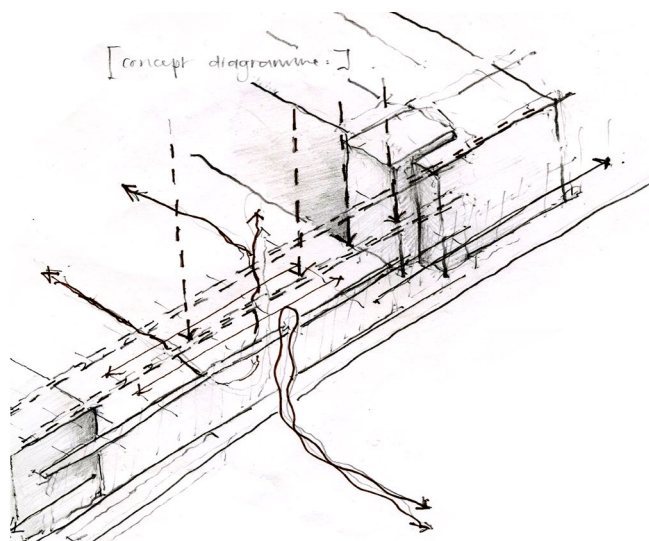
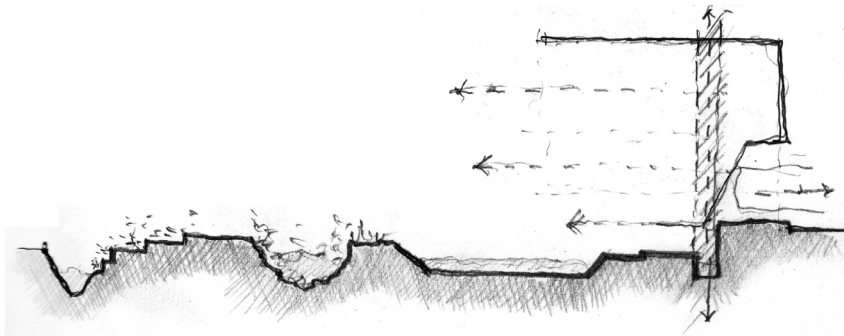
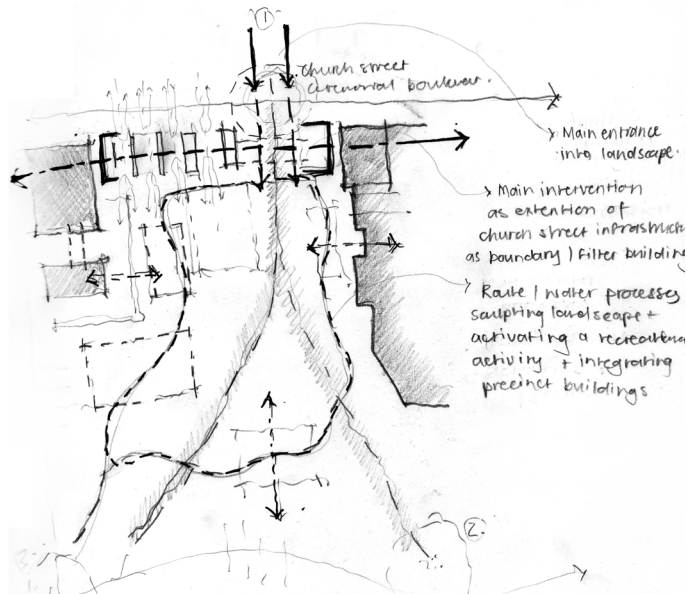


Figure 6.10: The development of the conceptual diagrammatic response to the site, illustrating the integration of the ground level linear water systems as a directional process, integrated with the exploitation of its ecological, social and economic opportunities, through an architectural intervention that facilitates these processes and their opportunities, creating spatial experiences that enhances these opportunities while simultaneously protecting and preserving the site's historic and environmental significance. (Author 2015)



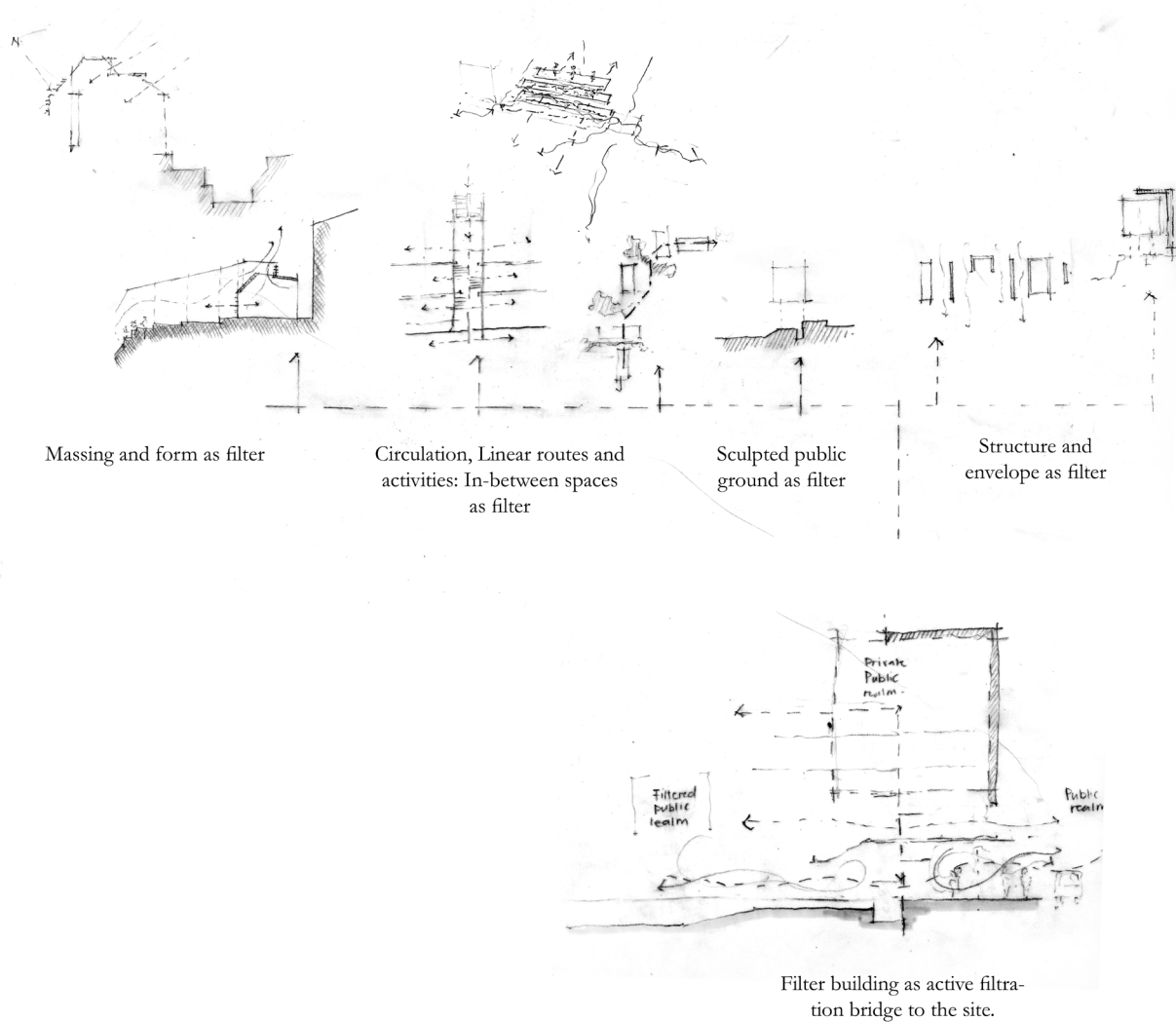


Figure 6.11: Summary of the conceptual intentions of the site and building that aims to become an architectural filter as an extension of the existing infrastructure of the urban realm, Church Street and the regenerated Apies River Island. (Author 2015)

6.4

Programmatic Informants

6.4.1

Defining the Programme

The programmatic response is developed as a response to the contextual informants and conceptual intentions for exploiting infrastructural opportunities through the creation of a constructed artificial landscape that is driven by the production of directive and generative public space, as well as the reinvention of existing infrastructure as socio-economic agent.

The programme as cultural urban arena becomes an adaptive, dynamic infrastructural device of a performative public spectacle, established on the Ceremonial Boulevard between Church Square and the Union Buildings. This intensified public realm would consist of a decentralised urban stormwater filtration system and a cultural memory park, as social, economic and recreational facilities bordering the inner city and its surrounding suburbs.

The proposed recreational and socio-economic appropriations represent possible scenarios of the animated infrastructure. Thus the programmatic response requires an alternative reimagination of a hybrid typology that addresses the need for inter-operability and adaptable appropriations that would encourage urban scenarios of social and economic engagement at different time cycles, continuously activating the precinct and enhancing a symbiotic relationship towards resilient urbanisation.

6.4.2

Potential Client Profile

Determined by the programmatic response and the infrastructural nature and scale of the investigation, the potential client would be a public-private partnership between local government authorities and City Property.

Various departments of the local government authority, the City of Tshwane Metropolitan Municipality, currently participate in the management and development of different categories of the city's infrastructural services. A collaborative strategy between the following three departments as public stakeholders is to be implemented in the management of the proposed design intervention, and are identified as the following:

The Department of Agriculture and Environmental Management. Their current responsibilities include the management and maintenance of parks, landscaped public spaces, nature reserves, resorts and public swimming pools.

Their various partnerships with private stakeholders aim to ensure a sustainable environment. One of the initiatives within the environmental management department relevant to the project includes The SEED (Sustainable Energy and Climate Change) programme that aims to encourage the integration of environmental concerns into urban development within the city through a focus on the efficient use of natural resources.

A subdivision of the Department of Agriculture and Environmental Management includes the Parks and Horticulture division that aims to conserve and develop the city's natural resources through the promotion of outdoor leisure facilities, such as public swimming pools, for the benefit of the residents of and visitors to the city.

The second municipal stakeholder identified is the Sports, Recreation, Arts and Culture department that focuses on the provision and maintenance of recreational facilities as well as arts, culture and heritage in the city.

Their responsibilities include the holding of events and provision of programmes to enhance sports, art and culture, as well as the maintenance and provision of facilities for events and cultural festivals. Their various initiatives also integrate with the programmes of the Department of Arts and Culture that provide financing, management, advocacy and networking of cultural development through various partnerships with organisations such as BASA (Business and Arts South Africa), a public/private partnership, to promote greater participation in the arts by South African businesses locally and internationally.

The third municipal stakeholder is identified as the Service Infrastructure department, specifically the Water and Sanitation subdivision responsible for the development, provision and maintenance of sustainable, high quality water and sanitation services, especially through the Water Conservation Programme and its extended social benefits.

The private stakeholder is identified as City Property, a residential and commercial property management company involved in a diverse range of development projects, ranging from traditional shopping malls, convenience shopping centres, industrial workshops, warehouses, offices, shops and flats .

Their focus in the city of Pretoria is mainly on the transformation of existing buildings through the investment and upgrading of affordable inner city accommodation and commercial and retail space, as well as recent investment in the development of tertiary educational institutions surrounding the project precinct. The residential building adjacent to the proposed project is currently owned by City Property and provides affordable accommodation to students and youth in the CBD. The project therefore aims to extend the recreational and socio-economic value that the site has to offer through the integration of the existing and proposed programmes.

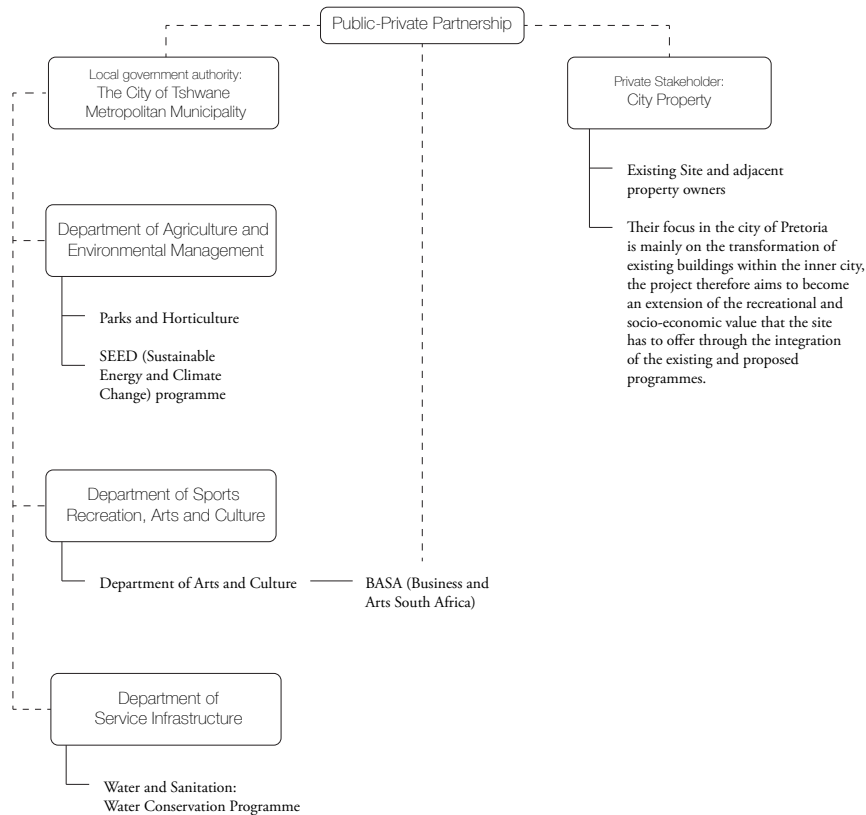


Figure 6.12 illustrates a diagrammatic summary of the various identified public and private stakeholders, as well as some of the significant initiatives that could benefit the development of the proposal. (Author 2015)

6.4.2

Defining the Programmatic and Spatial Requirement

| Programmatic Breakdown and Spatial Requirements | | | |
|--|------------------------------|--------------------------|---|
| Programmatic function | Area | Design population | Programmatic and Spatial Design Considerations |
| Recreational Landscape | | | |
| Entrance Lobby / Tourist Information Centre | 120 m ² | 10 | Transparent entrance platform, suspended behind Lion bridge as Entrance to the Park. To accommodate an information and management desk to recreational facilities, exhibition activities and auditorium and meeting space administration. To accommodate a central information area with regards to all tourist related activities, as well as information on the built heritage significance of the surrounding locations and a small exhibition of the Apies River historical transformation itself. |
| Market Spaces | 24 m ² per stall | 6 stalls | Façade enclosures to be adaptable to allow an integration with the pedestrian activity on the Ceremonial Boulevard and Pretorius Street. Stalls to include lockable storage space. |
| Outdoor Sports Court | 1000 m ² | 420 | Multi-functional outdoor sports court and public gathering space. Size requirements according to a standard basketball court. To be sunken 1800mm below street level to act as a flooding surface detention structure in case of any flooding occurrence at the confluence of the Apies River and Walker Spruit, exceeding the 75years flood line that is contained within the stormwater channel. |
| Public Swimming Pool | 188 m ² | 90 | To accommodate three 25m training lanes with an extended full depth leisure swimming area and additional shallow pool. |
| Ablution and Changing Room Facilities | | | As per SANS 10400 requirements - See Table 6,2 |
| Outdoor Wall Climbing / Accessible Roof | 250 m ² | | To be fixed to the structural circulation towers and accessed from the Soft landscaped recreational park with integrated walking routes extending from both sides of the site. The vegetation palette of the park will accommodate some of the established indigenous plant species growing along the channel edges as documented in the ecological mapping of the site. To include space for public transportation (bus and taxi) drop-off points as well as parking for staff and vehicle workshops adjacent to the park. |
| Landscaped Park Area | Appr. 2000 m ² | | |
| Recreational Social Club, Restaurant / Event Space | | | |
| Dining Area, Social or Event gathering space (Ground and First Floor) | 300 m ² | 150 (incl. 20 personnel) | Adaptable open floor space to be appropriated as programmatically required for everyday or event use. Ground Floor threshold to read as open to the landscape and material finishes to express an extension of the hard landscaped outdoor spaces. |
| Lounge / Bar Area (Ground and First Floor) | 180 m ² | | |
| Catering Kitchen (Ground Floor) | 75 m ² | | Ground Floor Catering Kitchen to serve as main food preparation and cooking facilities and include the following: Delivery area, Cold Storage, Dry Storage, Food Preparation Area, Cooking Area, Cleaning Area and Refuse Area. |
| Serving Kitchen (First Floor) | 30 m ² | | First Floor Serving Kitchen to be serviced by Ground floor Kitchen through a dumbwaiter for food purposes. |
| Delivery and Refuse Area | 75 m ² | | |
| Ablution Facilities | | | As per SANS 10400 requirements - See Table 6,2 |
| Public and Private Furniture, Installation and Sculpture Art Facilities | | | |
| Ground Floor: | | | |
| Retail Space | 160 m ² | 16 | Small scale retail space for the workshop art pieces and potential exhibition sales. |
| Reception | 15 m ² | | Access point and administration office to the workshop and studio spaces. |
| Workshop Space | 175 m ² | 12 | Artist wood and small scale metal workshop space. Light to be an important consideration as well as a spatial relationship with the first floor studio space. Separate space to be considered for loud activities. |
| Material Storage space | 130 m ² | | Recycled metal from the vehicle mechanics, surrounding site and adjacent scrap yard to be stored with other materials. |
| Ablutions | | | As per SANS 10400 requirements - See Table 6,2 |
| First Floor: | | | |
| Reception | 25 m ² | | Access and administration point to the public co-working office spaces. |
| Waiting / Informal meeting area | 25 m ² | | Waiting and informal discussion areas to the public co-working office spaces. |
| Public Office Space | 75 m ² | 7 | Public Office equipment and workspace available to rent on a short term basis for freelancers and part-time workers or travel related business providing an environment of productivity and opportunities for exchange. Public and Semi-private spaces to be considered. A spatial relationship with the creative studios and workshop to be considered. |
| Artist Studio Space | 125 m ² | 10 | Public Artist studio space to serve the workshop as design and desk working facility, therefore a spatial relationship with the workshop and public offices is important. |
| Exhibition Spaces 1 and 2 (First and Second Floor) | 175 m ² per venue | 36 | Open exhibition space for workshop pieces. The interior arrangement of the space and partitions must be adaptable to suit different exhibition requirements. Large access openings and a mechanical hoist to be provided for the relocation of exhibition pieces to the first and second floor. Southern daylight is an important environmental consideration for the interior spatial quality of the exhibition spaces. |
| Ablutions | | | As per SANS 10400 requirements - See Table 6,2 |

| Public / Student Conference facility | | | |
|--|--------------------|-----|---|
| Reception | 15 m ² | | Access and administration desk for the management of the auditoriums and meeting / conference spaces. Building Administration and management office. Lobby waiting spaces to the auditorium and meeting rooms, could also be appropriated as informal discussion areas. |
| Building Administration Office | 20 m ² | | |
| Waiting Area | 80 m ² | | |
| Auditorium 1 and 2 | 150 m ² | 150 | To provide auditorium seating for approximately 75 - 100 people per auditorium. Sightline calculations and acoustic treatment considerations to determine structural, spatial and material finish resolution. Sound lobbies to be considered at access points. See diagramme xx (sightline and acoustic research) |
| Meeting / Conference rooms | 75 m ² | 25 | Adaptable conference / meeting spaces. To be appropriated as a single venue or adapted to smaller spaces with internal partitioning. Acoustics and privacy, the control of interior lighting conditions for digital display equipment as well as access from the serving kitchen to be important considerations. To provide food and drink serving facilities to conference and auditorium events. A dumbwaiter to be provided to be served by the ground floor catering kitchen in terms of food preparation and cooking requirements. As per SANS 10400 requirements - See Table xx |
| Serving Kitchen Ablution Facilities | 25 m ² | | |
| Horticulture workshop | | | |
| Greenhouses | 250 m ² | | The following design considerations are important influences to the productivity of the greenhouses and are elaborated on in diagrammes. Materiality, orientation and volume of internal space to ensure stable climatic conditions, sun exposure, adaptable roof and wet wall coverage for lighting and ventilation, irrigation and feeding system, humidity control and drainage requirements. Office space with a computer system and small weather station to monitor and control the climatic conditions and irrigation system of the greenhouses. Storage space for the irrigation and feeding tanks of the greenhouses, to be either automatically or manually controlled by the computer system in the office space. Preparation and storage area for pre- and post greenhouse produce. To include workbenches, water supply, lockable storage for equipment and supplies as well as maintenance space and equipment for small scale machinery. Space for the mixing and storage of compost. Odour control of composting area to be considered. |
| Control room / Office | 15 m ² | 1 | |
| Feeding Storage | 10 m ² | | |
| Potting Shed / Workshop | 75 m ² | 4 | |
| Composting Area | 25 m ² | | |
| Refuse Storage | 15 m ² | | |

Table 6.1: Programmatic breakdown and spatial design considerations. (Author 2015)

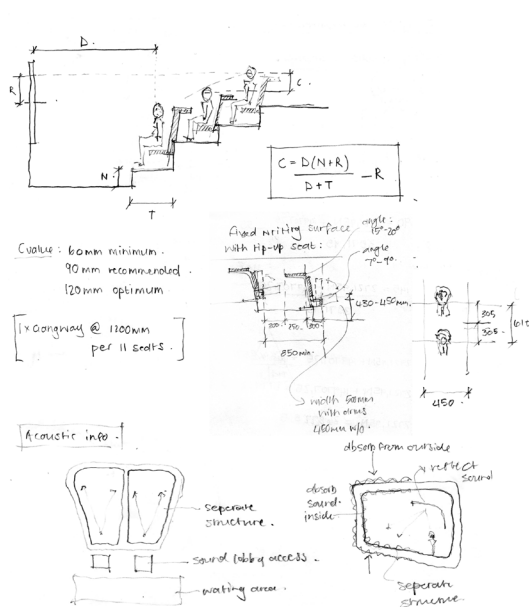


Figure 6.13: Diagrammatic journal sketches of auditorium spatial requirements and sightline calculations. (Author 2015)

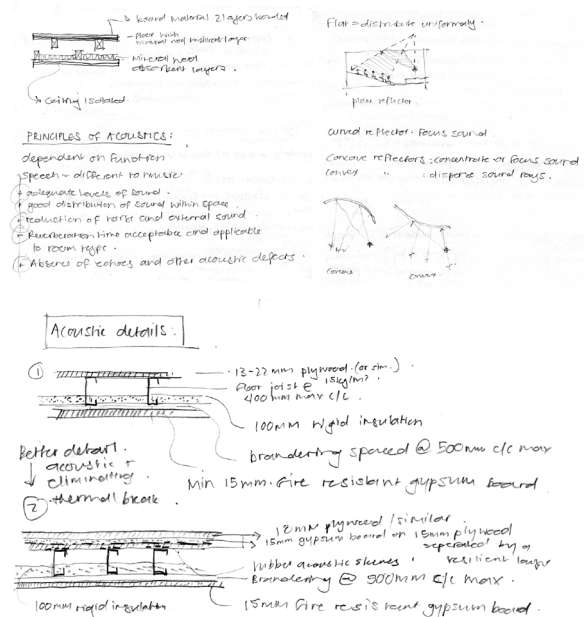


Figure 6.14: Diagrammatic journal summary of acoustic investigation for material requirements. (Author 2015)

6.4.3

Defining the SANS 10400 Requirements

SANS 10400 Classification and Sanitary Requirements

| Group | Design Classification | | | Population requirements | Area |
|-------|-----------------------|--------------------|-----------|-------------------------|------|
| | Programmatic function | Class of Occupancy | Occupancy | | |

Ground Floor

| | | | | | |
|---|---|----|-----------------------------------|---|--------------------|
| 1 | Recreational Park and dedicated Outdoor Sport and Public Pool Viewing | A1 | Entertainment and Public assembly | 1 person per 1 m ² | 400 m ² |
| | Outdoor Sports Court | A5 | Outdoor Sport | Number of Participants | 608 m ² |
| | Public Swimming Pool | A5 | Outdoor Sport | Number of Participants or Recreational: Area /2 | 188 m ² |
| 2 | Workshop | D2 | Moderate Risk Industrial | 1 person per 15m ² | 175 m ² |
| | Retail Shop | F2 | Small Shop | 1 person per 10m ² | 160 m ² |
| | Building Staff / Personnel | G1 | Offices | 1 person per 15m ² | 112 m ² |

First Floor

| | | | | | |
|---|--|----|-----------------------------------|-------------------------------|--------------------|
| 3 | Social Club (Ground and First Floor) | A1 | Entertainment and Public Assembly | Number of fixed seats | 480 m ² |
| | Exhibition Space | C1 | Exhibition Space | 1 person per 10m ² | 175 m ² |
| 4 | Co-working Spaces and Public Media station | B3 | Low Risk commercial Service | 1 person per 15m ² | 100 m ² |
| | Public and private Studios | B3 | Low Risk commercial Service | 1 person per 15m ² | 125 m ² |

Second Floor

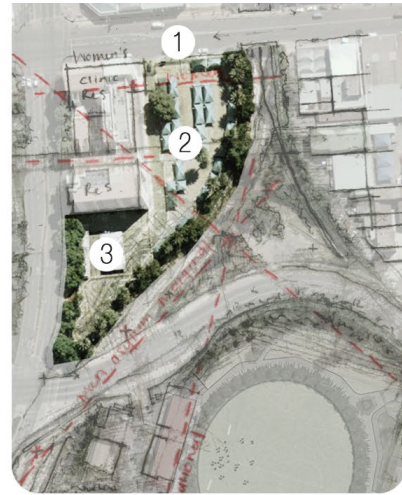
| | | | | | |
|---|------------------|----|-----------------------------|---|--------------------|
| 5 | Meeting Rooms | B3 | Low Risk commercial Service | 1 person per 15m ² or fixed seats | 110 m ² |
| | Auditoriums | A3 | Places of Instruction | 1 person per 5m ² or number of fixed seats | 150 m ² |
| | Exhibition Space | C1 | Exhibition Hall | 1 person per 10m ² | 175 m ² |

| Maximum design population | Sanitary requirements | | | | | | |
|---------------------------|--|----------|----------|----------|-----------|----------|----------|
| | Male | | | | Female | | |
| | WC | WHB | Urinal | Shower | WC | WHB | Shower |
| 400 | 1 | 1 | | | 1 | 1 | |
| 20 | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| 90 | 4 | 5 | 6 | 6 | 10 | 5 | 6 |
| 510 | 6 | 8 | 8 | 8 | 14 | 8 | 8 |
| 12 | (Included in Building staff Provision) | | | | | | |
| 16 | No Separate provision required | | | | | | |
| 8 | 1 | 2 | 2 | | 3 | 2 | |
| 36 | 1 | 2 | 2 | | 3 | 2 | |
| 150 (incl 20 personnel) | 1 | 2 | 2 | | 3 | 2 | |
| 18 | 1 | 1 | 1 | | 1 | 1 | |
| 204 | 2 | 3 | 3 | | 4 | 3 | |
| 7 | (Included in Studio provisions) | | | | | | |
| 10 | 1 | 2 | 2 | | 3 | 2 | |
| 17 | 1 | 2 | 2 | | 3 | 2 | |
| 25 | 1 | 1 | 1 | | 1 | 1 | |
| 150 | 1 | 1 | 1 | | 1 | 1 | |
| 18 | 1 | 1 | 1 | | 1 | 1 | |
| 193 | 3 | 3 | 3 | | 3 | 3 | |

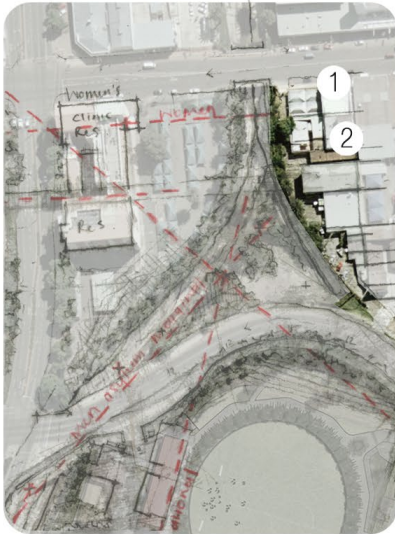
Table 6.2: SANS 10400 requirements. (Author 2015)



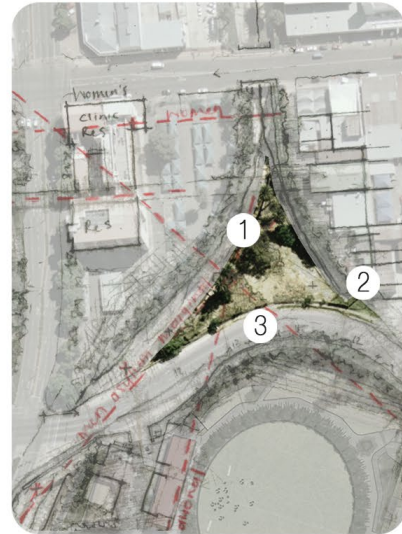
1. Entrance Lobby / Tourist Information Centre
2. Recreational Landscape and Circulation Route
3. Horticulture Greenhouses



1. Recreational Social Club, Restaurant / Event Space
2. Recreational Landscape
3. Horticulture Workshop



1. Public and Private Furniture, Installation and Sculpture Art Facilities
2. Outdoor Wall Climbing / Accessible Roof



1. Landscaped Park Area
2. Parking Area for Public Transport
3. Pedestrian bridge to Caledonian Fields

Figure 6.15 illustrates locating the proposed programmatic response to the site's contextual conditions. (Author 2015)

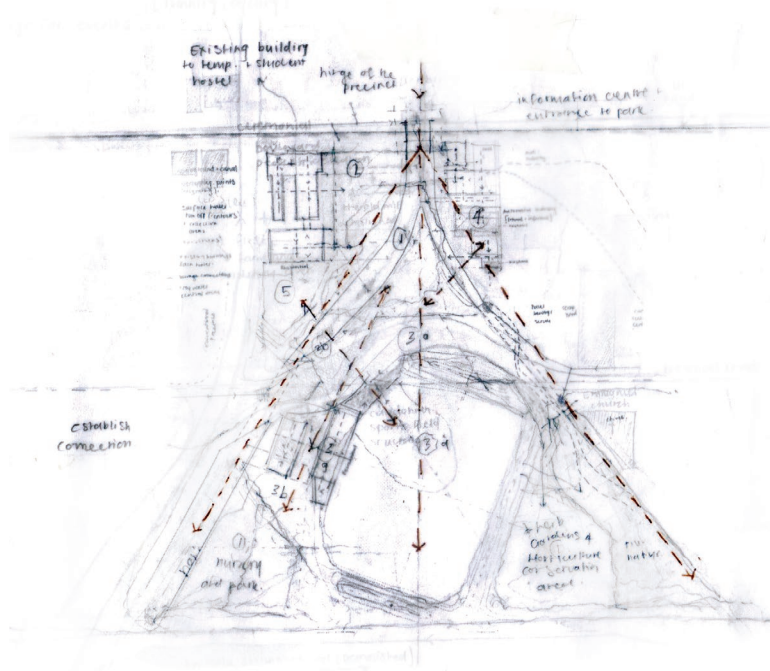


Figure 6.16 illustrates the development of the programmatic response to the existing and proposed contextual conditions. (Author 2015)

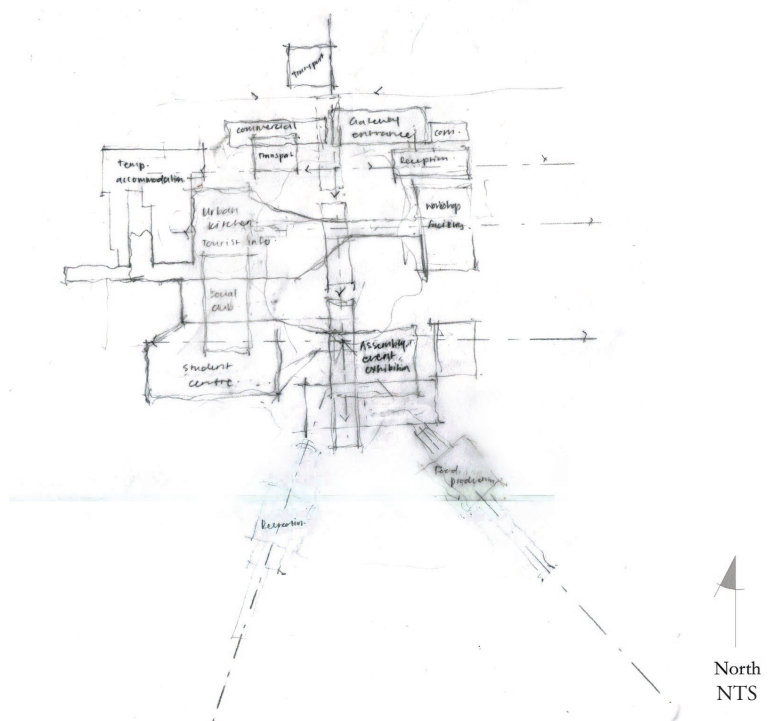
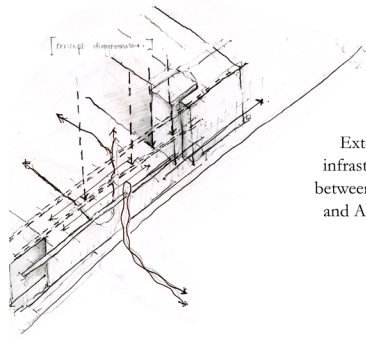


Figure 6.17 illustrates a further development of the programmatic response to the existing and proposed contextual conditions. (Author 2015)

Conceptual Development

By reimagining existing infrastructure as part of the production of form and space, the marginalised urban voids are regained for innovative design interventions, alternative occupation, and a new public appropriation that connects the city to the water.

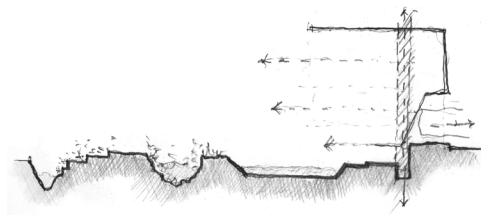
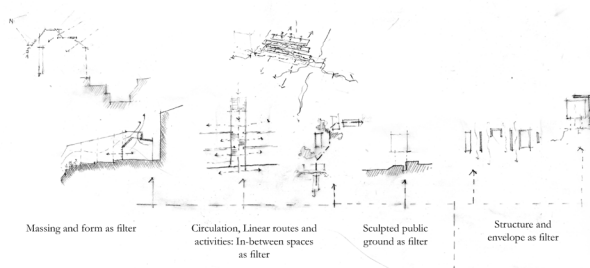
The proposed intervention aims to become an architectural filter as an extension of the existing infrastructure of the urban realm, Stanza Bopape Street and the regenerated Apies River Island.



Extension of existing infrastructure as threshold between the urban condition and Apies River landscape

Site Parti diagramme:
Infrastructure activating spatial opportunities

1. Filter building as active infrastructural edge to the site.
2. Constructed water channel activating the recreational public realm.
3. Multifunctional outdoor court as public square and detention flood structure.
4. Filter wall as active system edge between the Apies River channel and recreational activities.

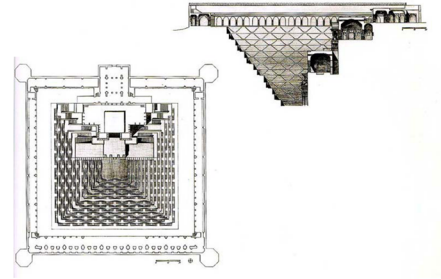


Sculpted Recreational Landscape

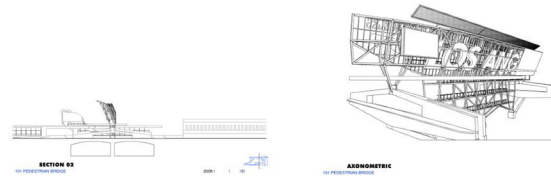
Structural and Service spine with Infrastructural towers
Internal and external edge response as threshold between city, structure and the 'artificial' landscape

Conceptual Precedent Studies

Precedent studies, as inspired by the conceptual intentions, are investigated to construct a synthesised architectural intention for the design development.



Habitable infrastructure as public spatial agent beyond its infrastructural use.
Ancient Indian Stepwells



Contextual Infrastructure:
Edge response and threshold conditions
Morphosis, Pedestrian Bridge 101



Urban Filter: Transparent transitions between city, structure and landscape
Jean Nouvel, Cartier Foundation



Adaptable Infrastructure: as space for experiments and spontaneous appropriations
J Mayer H, Schaustellen

6.5.1

Ancient Indian step wells

Project Information:

Location: All across India

Earliest date recorded: Approximately 550 AD

Relevance: Habitable infrastructure as public spatial agent beyond its infrastructural use

Louis Rousselet, a famous French world traveller, beautifully captured the ecological and biophilic potential of an ancient Indian well in 1864 as "[a] vast sheet of water, covered with lotuses in flower, amid which thousands of aquatic birds are sporting" Rousselet in (Livingston 2002:14).

Initially constructed around approximately 550AD, as a practical solution to the retention and supply of water for drinking and bathing facilities in extremely dry areas experiencing water scarcity, these ancient Indian step wells later became an important asset to their surrounding communities, offering more than just a practical solution through their contribution as public gathering spaces.

The structure of the step wells consists of an underground vertical shaft, used for the storage and harvesting of water. The steps or inclined subterranean walkways surrounding these wells provide access to the water itself as well as to the extended spaces used for leisure and religious activities.

The architecture of the wells differs according to type and locality, and is expressed through the carved decorations in the incorporated temples and public resting areas. These leisure areas provided relief from daytime heat and were mainly used by women collecting water and practicing their religious prayer and offering activities within these wells (Fabrizi 2014).

Ancient Indian step wells inspire significant architectural features, specifically the use of water integrated with space and public activities to contribute culturally and spiritually to the existence of the wells, beyond their utilitarian function.

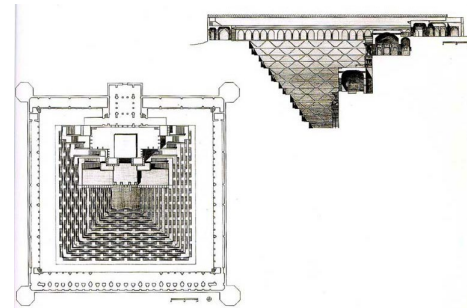


Figure 6.18: Chand Baori Stepwell in Rajasthan, India Plan and Section, (Fabrizi 2014)



Figure 6.19: Chand Baori Stepwell in Rajasthan, India Photo by Saumil Shah, (Fabrizi 2014)



Figure 6.20: Agrasen ki Baoli, Jantar Mantar, New Delhi Photo by Emma Rowe, (Fabrizi 2014)

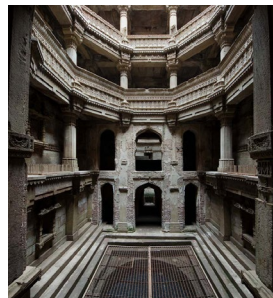


Figure 6.21: Adalaj Stepwell, Gujarat, India Image from Lord's flickr page (Fabrizi 2014)

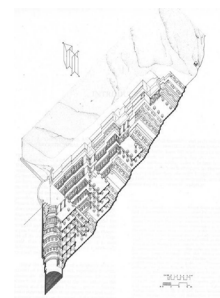


Figure 6.22: Rani ki Vav, Gujarat, India : Axonometrical Section (Fabrizi 2014)

6.5.2

Morphosis Architects, Pedestrian Bridge 10

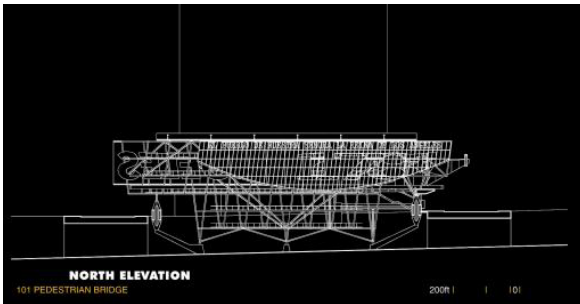


Figure 6.23: North Elevation drawing (Morphopedia 2009)

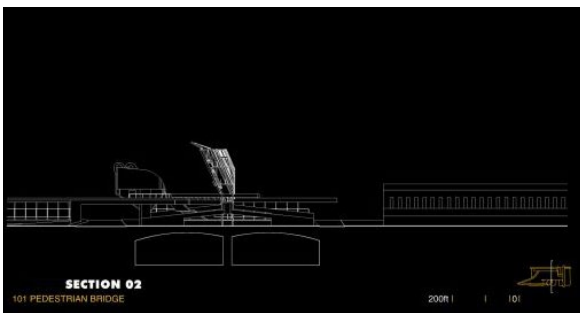


Figure 6.24: Section drawing (Morphopedia 2009)

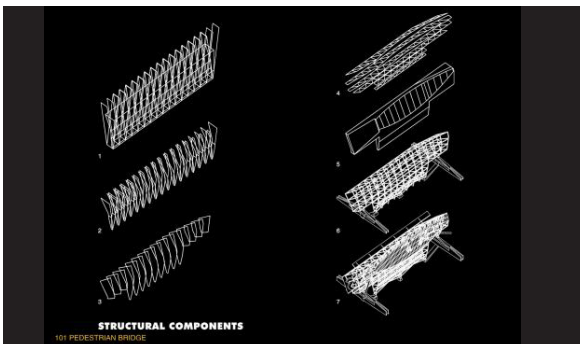


Figure 6.25: Exploded structural drawing (Morphopedia 2009)



Figure 6.26: Axonometric drawing (Morphopedia 2009)

Project Information:

Location: Los Angeles, California, United States of America

Design Date: Competition entry 1998

Client: Metropolitan Transportation Authority, Los Angeles

Project team:

Lead Designer: Morphosis Architects

Partner: AIJK Architecture and City Design

Civil Engineer: Ove Arup and Partners

Structural Engineer: Ove Arup and Partners

Collaborative Artist: Jenny Holzer

Relevance: Bridging the division between significant public facilities through contextually responsive infrastructure

The relevance of the precedent study is directly related to the prevalent condition of transportation infrastructure spatially fragmenting the public realm within the city of Pretoria. The main intention of the 101 Pedestrian Bridge Project Design Competition was to reimagine the existing infrastructural entities to exploit the potential of an improved civic connection between Union Station and the City Hall, separated by the 101 Freeway.

The design proposal by Morphosis Architects emphasises the contextual significance of the potential project through an extension of the historic district (Olvera Street) as overpass into the Civic Centre, activated by retail activities, unconventional artificial landscaping and exhibition areas for artists.

The parti response of the structure acknowledges the two different contextual edge conditions with its linear edge facing new Los Angeles to the south, supporting a curved panel of weathered Corten steel, with the original name of the city engraved. This semi-transparent façade encloses a public “living room” in the middle of the city. The northern edge response supports an electronic display of scheduled events reflecting the extent of its cultural activities. A large staircase leads to the elevated platform as observation deck, orientating pedestrians to the historical Main Street axis and city skyline (Morphopedia 2009).

6.5.3

Jean Nouvel, Cartier Foundation, Paris

Project Information:

Location: Boulevard Raspail, Paris, France

Completion Date: 1994

Client: Gan Vie

Project team:

Lead Designer: Jean Nouvel, Emmanuel Cattani & Associés

Project Manager: Didier Brault

Structural Engineer: Ove Arup and Partners

Landscape Architect: Ingenieur et Paysage

Relevance: Architecture as urban filter and extension of the landscape

Reproducing the lines of the boulevard, the glass walls enable passers-by to admire the extraordinary interplay between structure and nature that characterizes the building – Jean Nouvel in (Sveiven 2010).

Described by Nouvel as ‘the phantom in the park’, the Cartier Foundation, as boundary to a garden within an urban environment, successfully filters the external and internal conditions, creating a fluid transition between the experience of the structure and the experience of the landscape through the lightness of its steel and glass materiality as well as the adaptability of the boundary enclosures. From the street entrance, the transparency of the structure allows for the reading of the extent of the site’s depth aesthetically expressing the rhythmic relationship between the repetitive column structures and vertical landscape elements such as trees.

Despite its scale and mass, the contemporary exhibition space seemingly blends into its context through its sensitively curated relationship to neighbouring buildings and the reflectiveness of the façade, allowing visitors to experience the building and context simultaneously at different scales.

An architecture that plays on blurring the tangible limits of the building and rendering the reading of a solid volume superfluous, in a poetics of ambiguity and evanescence – Jean Nouvel in (Sveiven 2010).



Figure 6.27: Entrance facade of the Cartier Foundation
Photo by Tasha Farris, (Farris 2009)



Figure 6.28: Ground Floor open threshold
Photo by Annette Galinski, (Galinski 2011)



Figure 6.29: Relationship to the adjacent existing building
Photo by David F. Gallagher, (Sveiven 2010)



Figure 6.30: Integration of the structure and the landscape
Photo by David F. Gallagher, (Sveiven 2010)

6.5.4

J Mayer H, Schaustelle, Munich



Figure 6.31: Aerial photograph of the Schaustelle in context
Photo by Rainer Viertlböck, (Schaustelle 2013)

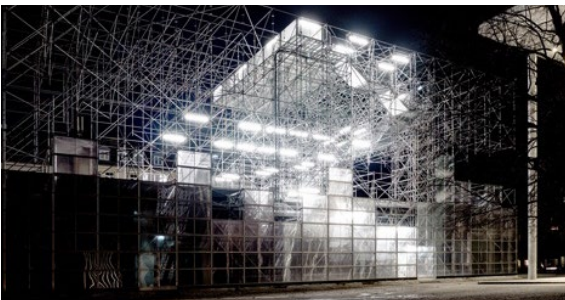


Figure 6.32: Schaustelle activity at night
Photo by Dennis Bangert, (Schaustelle 2013)

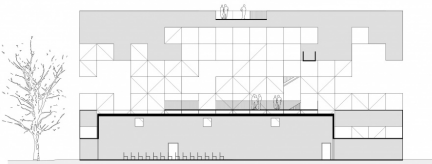


Figure 6.33: Longitudinal Section through the building illustrating the Main auditorium / exhibition space and social platforms above. (Kaltenbach 2014)



Figure 6.34: Building components of the Schaustelle transported to be reused after being dismantled
Photo by Frank Kaltenbach, (Kaltenbach 2014)

Project Information:

Location: Pinakothek der Moderne, Munich, Germany

Date: February - September 2013

Client: Freistaat Bayern, Ministerium für Wissenschaft, Forschung und Kunst, Stiftung Pinakothek der Moderne

Project team:

Architects: Team J Mayer H: Jürgen Mayer H., Marcus Blum, Paul Angelier

Relevance: Adaptable infrastructure as space for experiments and spontaneous appropriations

As a temporary open-ended platform for interaction, interdisciplinary exchange and adaptability, the Schaustelle designed by Jürgen Mayer H. is a 400 m² scaffolding structure facilitating the operations of the Pinakothek der Moderne under renovation. Named as ‘show site’, the functionality and structural integrity invokes a variety of associations, specifically that of spontaneous appropriations and potential development.

The lightness and transparency of the structure allows a simultaneous experience of the interior spaces and activities against the backdrop of revealed moments of the city beyond. Visitors are led into the higher-level exhibition platforms and central social spaces through a central circulation staircase.

A major influence on the skeletal structure, housing exhibitions, film screenings, talks and other events of the adjacent museum, was the reusability of its construction elements such as the scaffolding itself, the containers, and the synthetic cladding, expressing its conceptual intentions of suitability, extensibility and reduction to its structural essence (Schaustelle 2013).

07

CHAPTER SEVEN

DESIGN DEVELOPMENT

Introduction
Design development Iterations

7.1 Introduction

The design concept as defined by the contextual, conceptual and programmatic intentions of the project are developed into a set of diagrams that encapsulate the conceptual and architectural intention of the project.

Figure 7.1 to Figure 7.3 diagrammatically illustrates the three primary conceptual intentions of the project as:

- A - Sculpting the landscape through a reinvention of the existing water infrastructure, with the new interventions as contextual response.
- B - The structural and service spine becomes an extension of the sculpted landscape as stereotomic boundary wall and structural cores.
- C - The internal and external edge conditions, as serviced by the structural and service spine, respond to the different contextual conditions.

Selected significant design iterations, as documented throughout the design process, are introduced through their main objectives and discussed according to the development of the three primary conceptual intentions as outlined above, in order to illustrate a collective image of how the development influenced all three of the conceptual intentions concurrently.

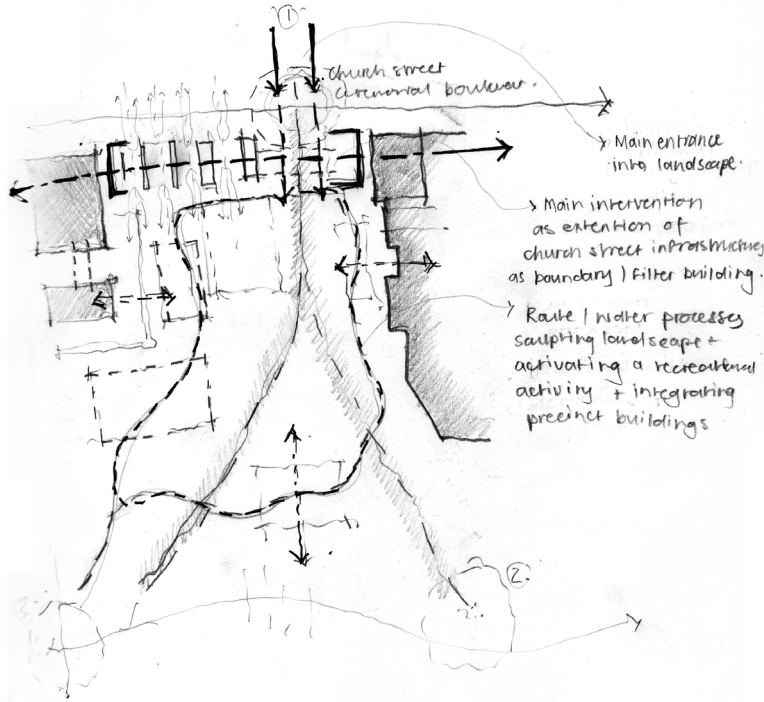


Figure 7.1: Plan diagramme of the conceptual intentions for the site, illustrating the primary continuing the infrastructure of the ceremonial boulevard across the Apies River channel as architecture emphasising boundary and filtration into the landscape. (Author 2015)

The route and water processes along the landscape activates the programmatic intentions while simultaneously integrating the existing conditions within the precinct.

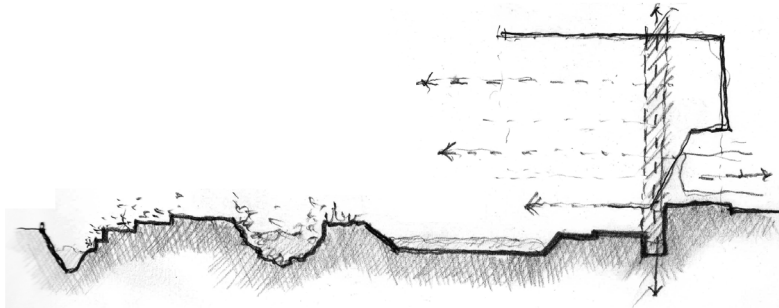


Figure 7.2: Section diagramme of the conceptual intentions for the site, illustrating the sculpting of the landscape that activates and integrates water ecological and socio-economic intentions. (Author 2015)

The primary intervention responds to the internal and external edges as filter and boundary structure.

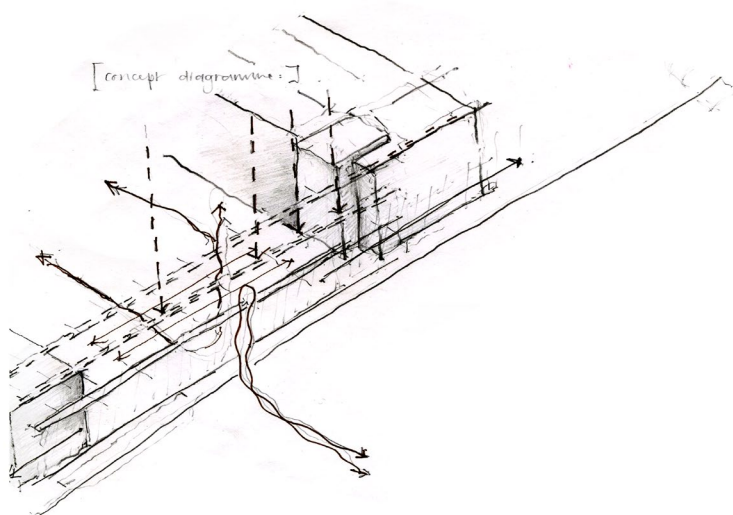


Figure 7.3: Perspective diagramme illustrating the primary intervention as extension of the Ceremonial Boulevard Infrastructure and continuation of public activities along the street edge, while simultaneously acting as boundary and filtration structure to the potential of the landscape. (Author 2015)

7.2

Design development Iterations

7.2.1

Iteration 1:

A return to the 'natural' significance

Inspired by the historic identity of the Apies River Corridor as significant natural and recreational resource in the city of Pretoria, the first iteration proposed an attempt to reinscribe this significance and its associated biophilic potential through the construction of an artificial wetland as an integration of the city's natural systems and cultural engineering arsenal. The proposal of this constructed wetland aimed to enhance the biodiversity, water quality and recreational opportunities of water in an urban context as well as provide a more sustainable approach to urban stormwater treatment.

In many suburban areas, wetlands are among the last remnants of natural vegetation in the landscape. Wetlands are thus important elements of the natural capital of urban ecosystems. They often serve or are expected to serve multiple functions within the system: storm water detention, water storage, treatment of wastewater/ water quality improvement, maintenance of wildlife habitat, human recreation, education, and aesthetics. As more land in the surrounding area is converted to development, and population densities and demography change, increasing pressure is placed on those wetlands that remain to serve these multiple functions, some of which are incompatible. The potential for cumulative impacts of stressors on urban wetlands means that these impacts cannot be analysed in isolation (Hemond & Benoit in Ahlers 2006: iv).

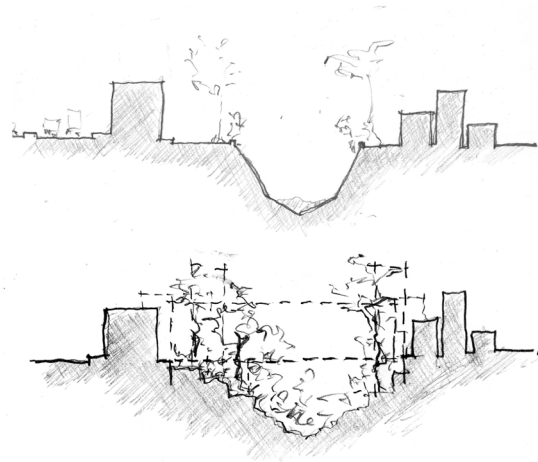


Figure 7.4: Conceptual diagramme illustrating the intentions of iteration 1: A return to the natural significance (Author 2015)

A
Sculpting the landscape

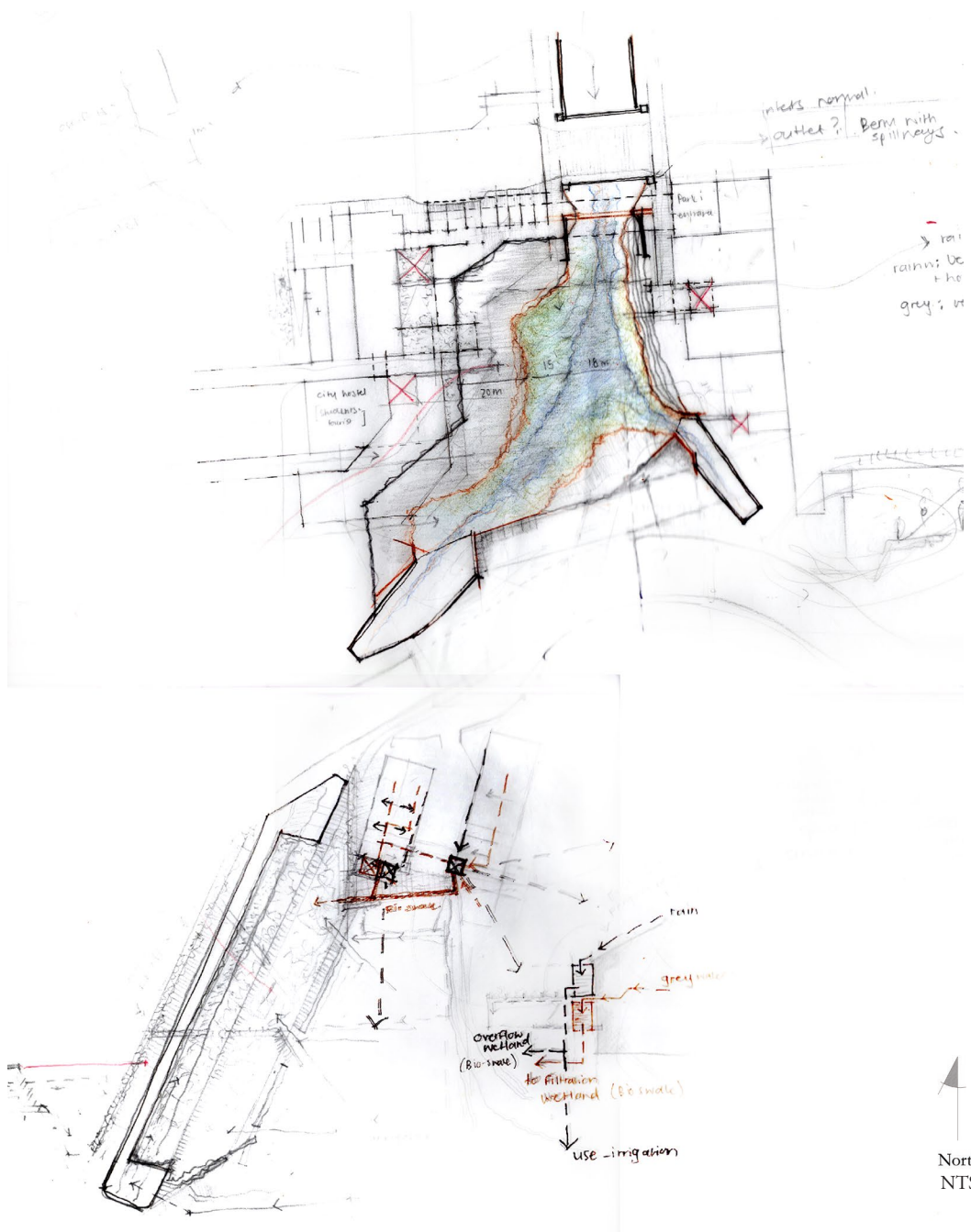


Figure 7.5: First site development of the interventions within the existing concrete channel and proposal of the constructed wetland and adjacent structures. (Author 2015)

Figure 7.5 and Figure 7.6 illustrate the first iteration of strategically selecting areas of the concrete channel to be removed and replaced by natural rock barriers and terraced landscaped surfaces, constructing a wetland in the central area of the three identified sites on the Apies River.

Figure 8.5, 8.6 and 8.7 illustrate the double-ended conceptual approach, as discussed in the previous chapter, of simultaneously sculpting the landscape whilst developing a vision for the new architectural intervention through identifying contextual points where opportunities exist for utilising water.



Figure 7.6: First site development of the structural interventions as contextual and programmatic response within the constructed wetland. (Author 2015)

Figure 8.6 and 8.7 both diagrammatically indicate the opportunities for integrating the water processes of the existing precinct, as identified through the mapping of the existing water infrastructure, with the new intervention and recreational activities, such as the development of a pedestrian route, with the aim of establishing a relationship between and consequently exposing significant contextual informants within the precinct and site. This development, as illustrated through the conceptual drawings, aims to resemble the former natural state of the river, exploiting the possibilities of a water system towards making an aesthetic, ecological and recreational contribution to the city context.

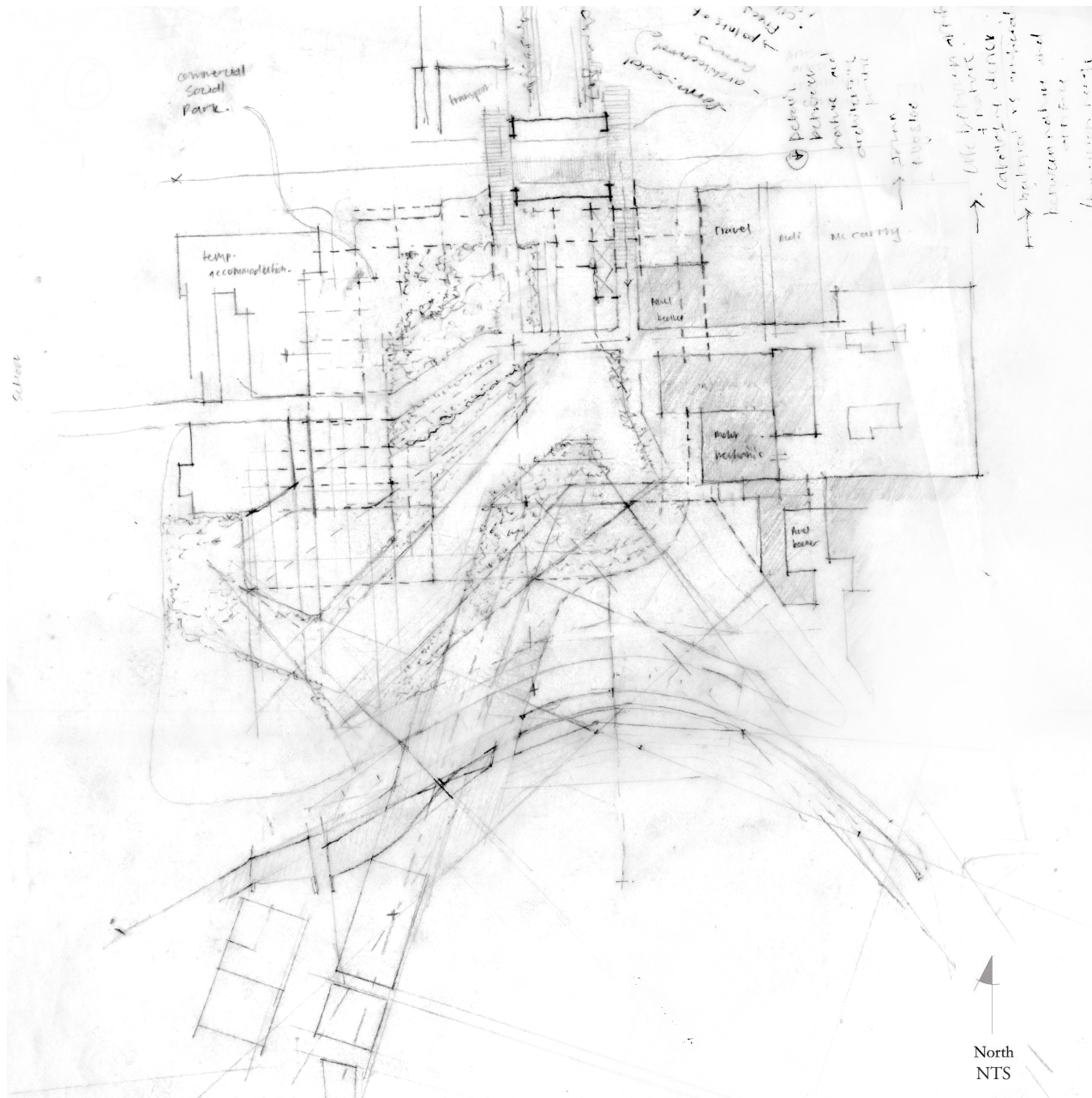


Figure 7.7: Further development of the structural interventions as contextual and programmatic response, containing the central on-structed wetland landscape. (Author 2015)

Figure 8.8 and 8.9 illustrate the sectional potential of sculpting the landscape into a constructed natural entity, as well as the identification of consequential recreational and spatial opportunities.

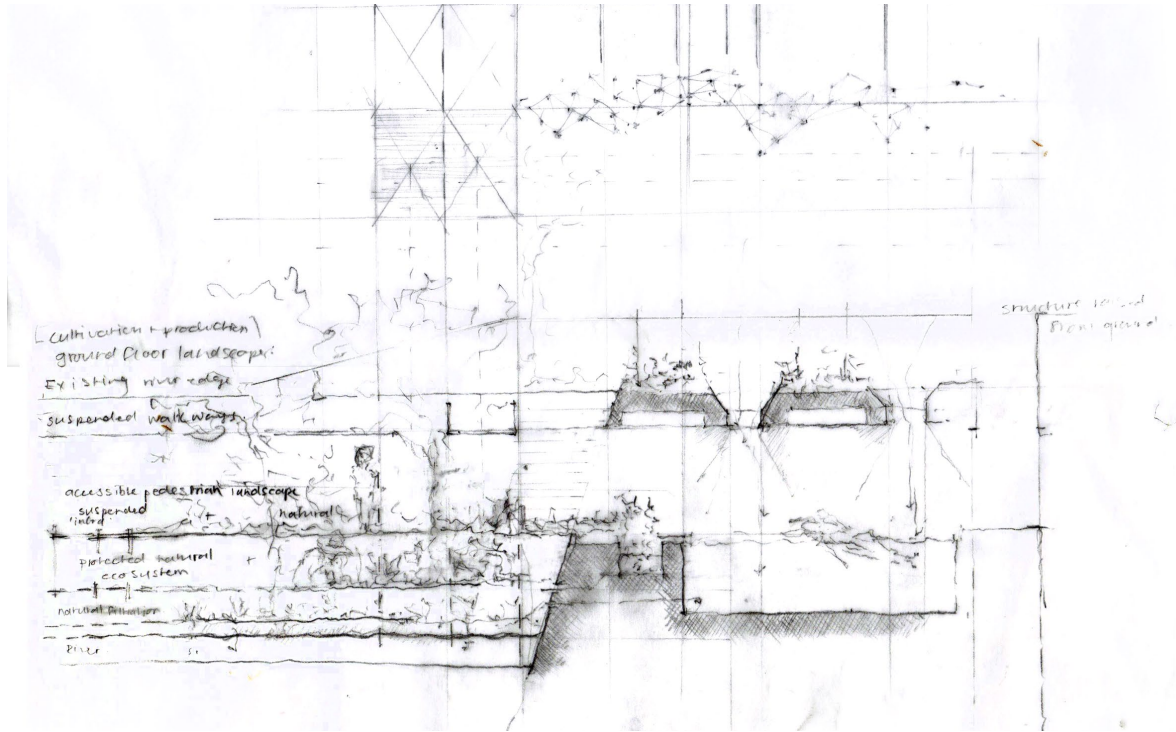


Figure 7.8: First conceptual sectional development of the spatial and programmatic opportunities within the reconstructed landscape. (Author 2015)

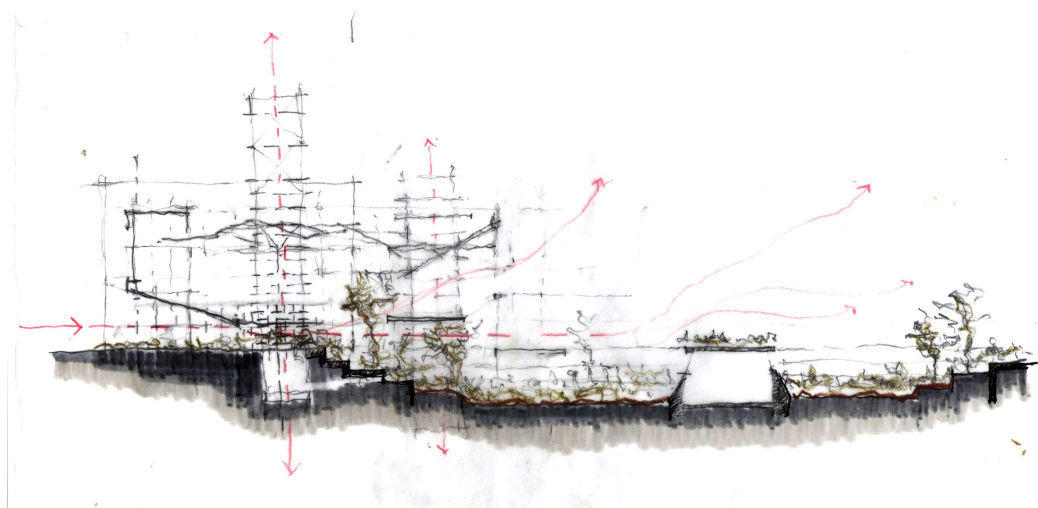


Figure 7.9: First sectional development of the structure as a response to the reconstructed 'natural' landscape and natural water processes of the site. (Author 2015)

C

External and Internal edge response

Figure 8.8 and 8.10 illustrate the sectional potential of integrating water infrastructure as spatial and structural informant for developing a contextually appropriate formal response to the water systems, sculpted landscape, and both external and internal edge conditions of the intervention.

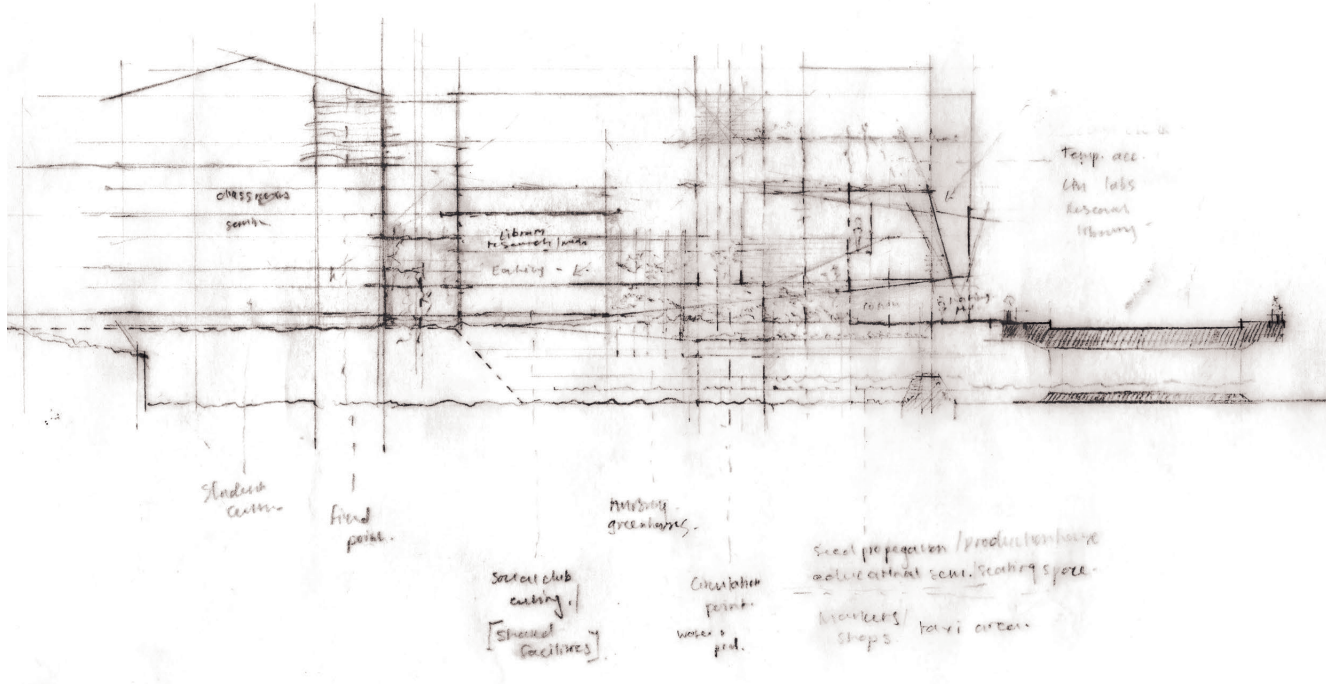


Figure 7.10: First sectional development of the structural interventions as contextual and programmatic response towards the internal landscape and external street conditions. (Author 2015)

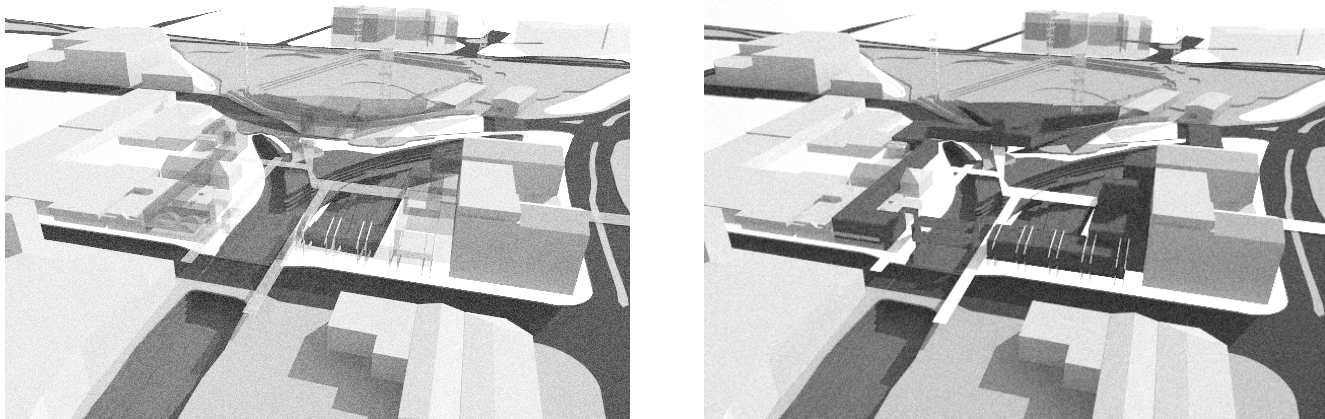


Figure 7.11: First sectional development of the structure as a response to the reconstructed 'natural' landscape and natural water processes of the site. (Author 2015)

7.2.2

Iteration 2:

Exploiting ecological, water and spatial opportunities through a reconstruction of an integrated artificial system

Due to the 'removal' of the natural water system and its ecological potential from the city through the extent and depth of the concrete stormwater channel, and urbanisation that consequently grew towards the edge of the channel, an immense challenge is presented: to return the river to its historic natural significance through an actual return to the construction of a 'natural ecological system' within this densely developed context. In order to successfully implement an intervention on such a vast scale, the water system of the Apies River Corridor in its entirety needs to be evaluated and reconstructed selectively to prevent the return of the ecological threat and hazards that led to the implementation of its concrete entombment. The various strains and impacts that urbanisation and the development of cities have on natural entities, however, demand an alternative approach towards exploiting the range of biophilic qualities and the potential of these natural systems through an artificially constructed realm that would allow for a return to an ecological and recreational identity without literally reconstructing the 'natural'.

The iteration therefore proposes a constructed artificial landscape that collectively harvests, treats and reuses water from the precinct and intervention itself for various activities, as filtration point to the site and larger river network. It subsequently feeds excess treated water back into the river system to be used for agriculture in the northern areas beyond the city, aiming to enhance the quantity, quality and biodiversity of water in natural areas, as well as the river's ecological potential and presence within the city.

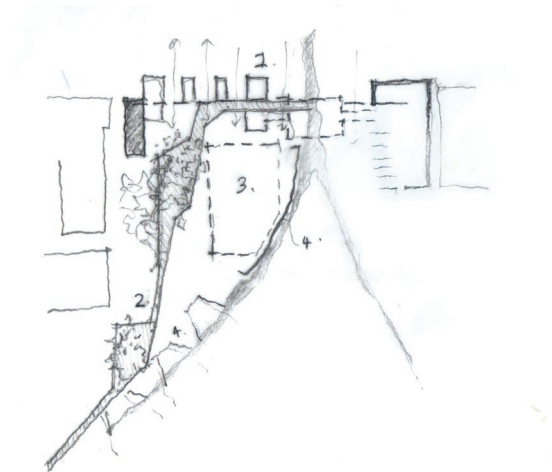
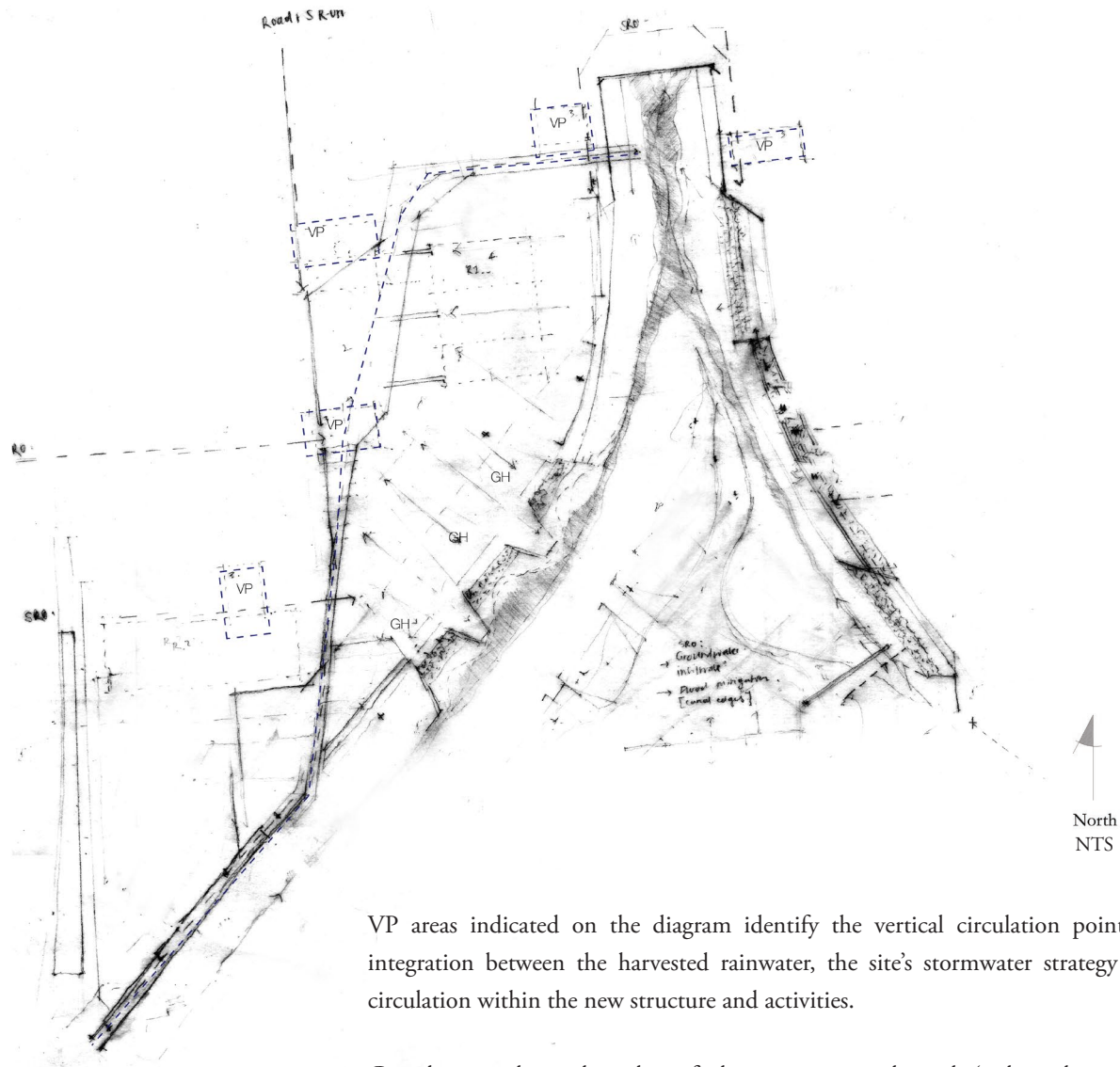


Figure 7.12: as parti diagram to the site vision, illustrates the reconstruction of the artificial landscape through the creation of four primary elements, as discussed below. (Author 2015)

1. The proposed building intervention becomes an extension of the collective existing infrastructures (ecological, water, social and transportation) as filtration boundary structure between the Ceremonial Boulevard as active urban realm and the contained regenerated landscape.
2. An artificially constructed processional water channel, informed by the mapping investigation of the existing water infrastructure of the precinct, is proposed as a continuous entity throughout the site and building, activating the site activities through the exploitation of its recreational, aesthetic and ecological potential.
3. The multifunctional outdoor court is proposed as the central public gathering space, and is sunken into the landscape as part of the sculpted form to act as detention structure in the event of flooding at the confluence of the Apies River and Walker Spruit.
4. The edges of the concrete stormwater channel are reconstructed in various ways at identified strategic points, as a response to the adjacent activities.

A
Sculpting the landscape



VP areas indicated on the diagram identify the vertical circulation points of integration between the harvested rainwater, the site's stormwater strategy and circulation within the new structure and activities.

Greenhouses along the edge of the stormwater channel (indicated as GH) are irrigated with the harvested water in the channel system. A terraced edge is proposed that would allow spatial access to the currently inaccessible lower level of the channel that is contained within the 75 year floodline. The lowest levels of the terraced edges within the indicated floodlines are proposed to be vegetated as bioswale filtration edges to the irrigation runoff channels from the greenhouses.

Figure 7.13 illustrates the processional water channel and related water process informing the sculpting of the recreational landscape through harvesting stormwater runoff collectively throughout the site, and channelling it to a central small-scale constructed wetland, from which it is channelled to an underground storage reservoir for reuse within the precinct, with excess water fed back into the Apies River Corridor. (Author 2015)

The primary intervention, the boundary filtration structure between the Ceremonial Boulevard and the landscape, becomes the main inception point for internal activities and positions itself between the eastern and western adjacent buildings, bridging the channel at a higher level and therefore continuing activities across the currently fragmented condition resulting from the site being dissected by the channel. It addresses the industrial eastern edge of the informal motor mechanics and provides access and integration from the eastern edge of the site to the reconstructed landscape.

The identified route throughout the site aims to connect significant contextual conditions and selectively filter activity into the contained landscape at strategic points, while simultaneously exploiting the potential of integrating precinct activities with the site activities.

Activities along the extent of the site include the wetland area providing an aesthetic landscaped barrier and seating edge between the western adjacent residential building and the recreational public space, as well as the horticulture workshop and greenhouse walkways extending across the channel into the natural park, forming a pedestrian connection to the newly proposed Caledonian Commons to the south of the site that contains market spaces with public transportation and parking along Pretorius Street.

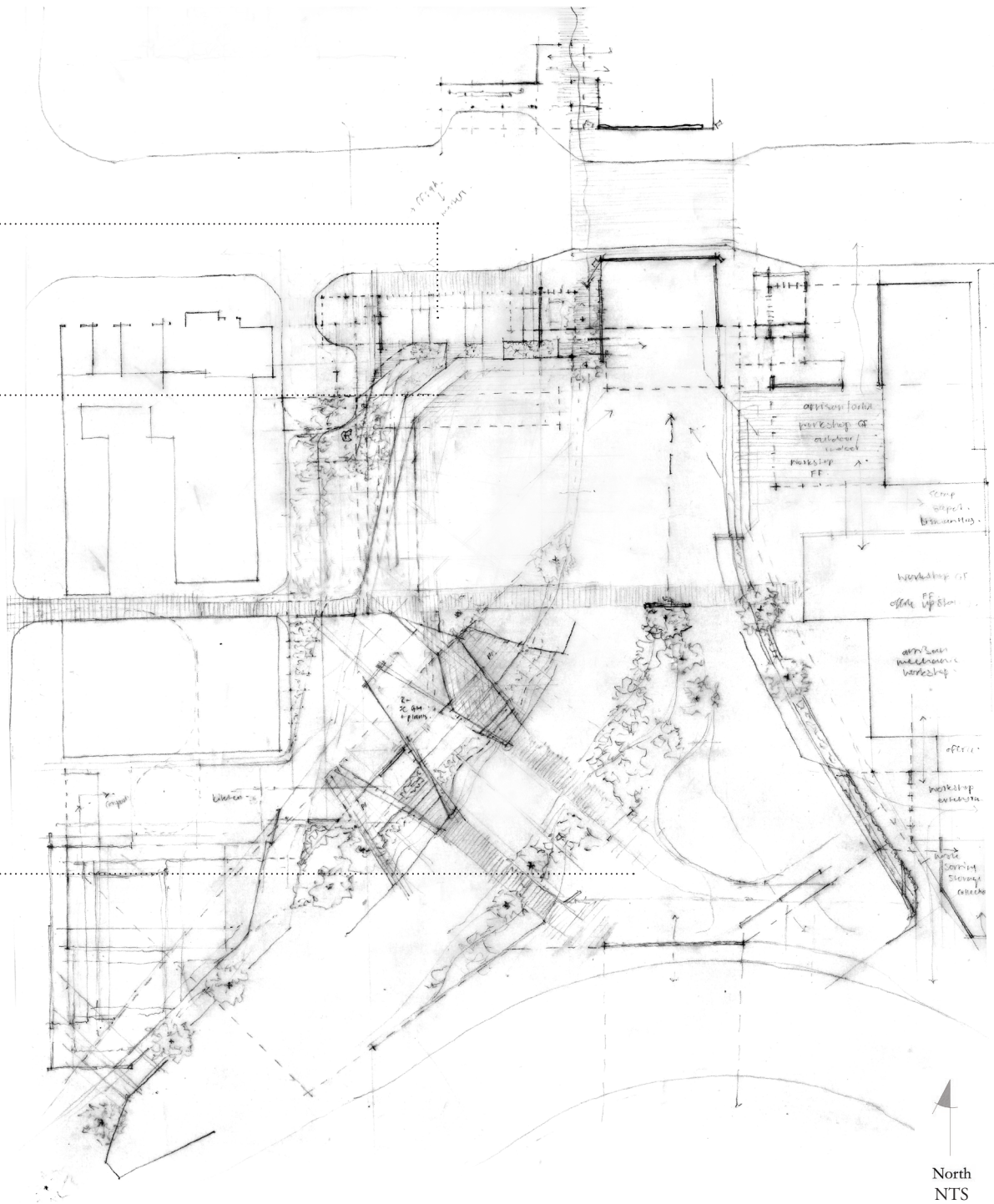


Figure 7.14 illustrates the programmatic and spatial activation of the site, developed from the iteration parti diagram as a simultaneous response to the sculpting of the landscape shown in Figure 7.12. (Author 2015)

B
Structural and service spine

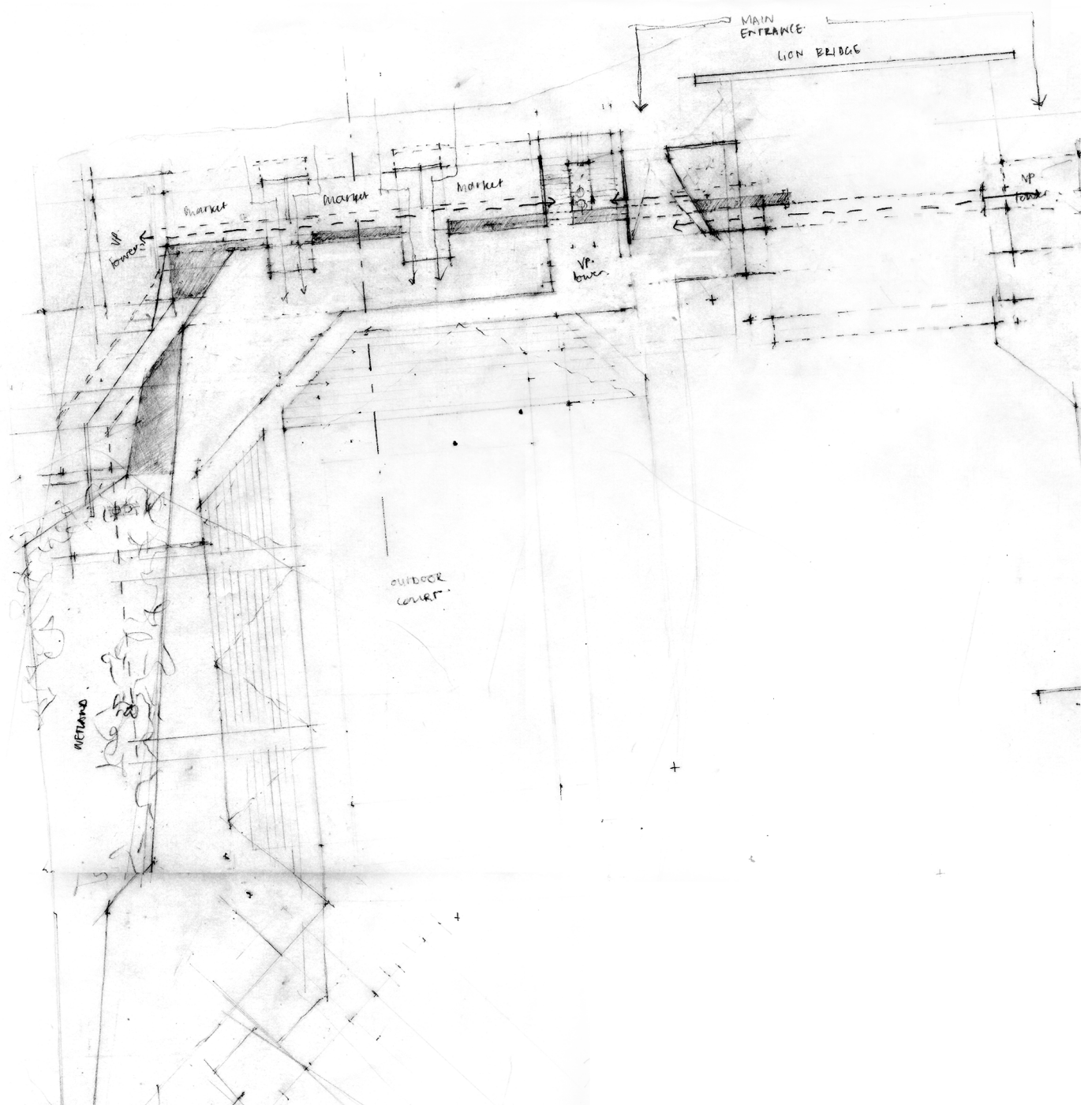


Figure 7.15: Further development of the primary building and structural interventions during iteration 2. (Author 2015)

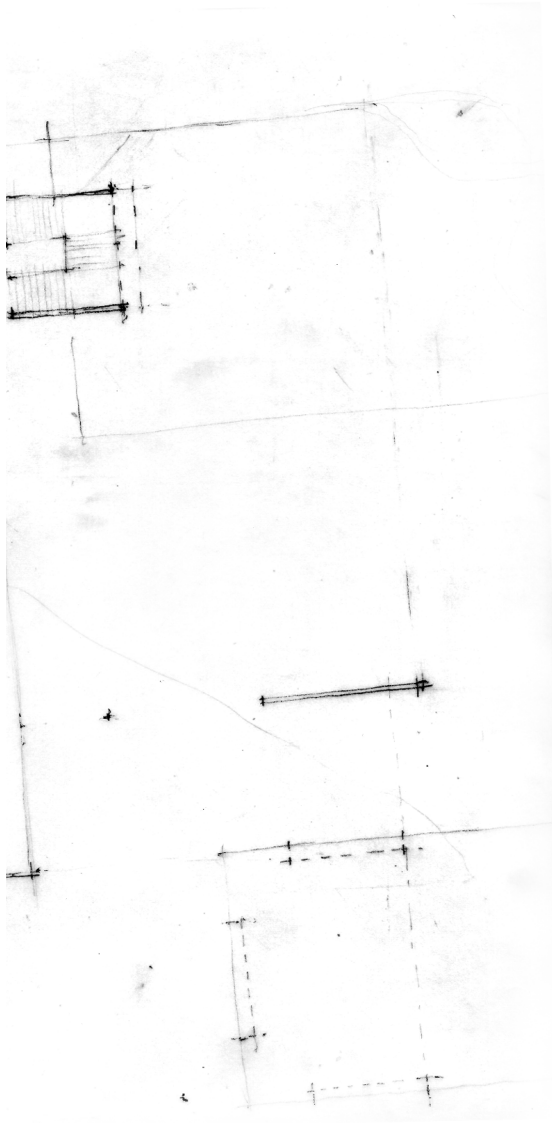


Figure 7.15 extends the development of the site response as discussed above into the building and structure itself. The contained landscape is extended into the ground floor space through the sloped edges of the public outdoor court and the adaptable thresholds and continuous surfaces defined by the circulation route through the site.

The vertical points of integration between water processes, circulation and activities, as identified in Figure 7.13, are developed into the three primary structural cores that serve the adjacent spaces, informing the development of the structural and service spine.

Access and circulation through the building itself become important informants of the design development. A central circulation route adjacent to the water channel all along the length of the building proposes a central circulation and service spine connecting the three primary structural and service core towers.

The main access points to the landscape and building are identified as the two edges adjacent to Lion Bridge and a long the circulation route through the site or into the opposite parts of the building. These emphasise and expose the significance of this historical structure under the expanse of the building. Secondary entrance points are proposed through the market spaces as identified in the drawing.

C
External and Internal edge response

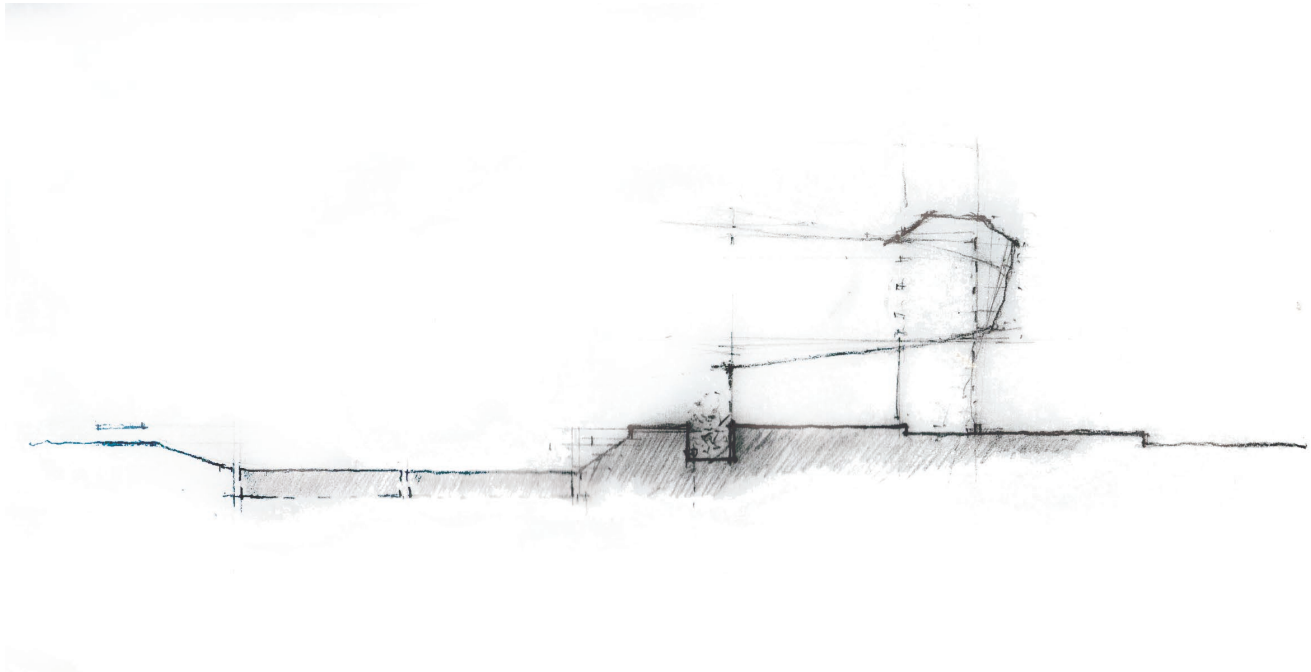


Figure 7.16 illustrates the sectional development of the continuous sculpted ground floor and water channel extending through the building, creating open thresholds from the street into the landscape. The external façade on the first floor contains and encloses activities to the open internal edge conditions that extend into the landscape. (Author 2015)

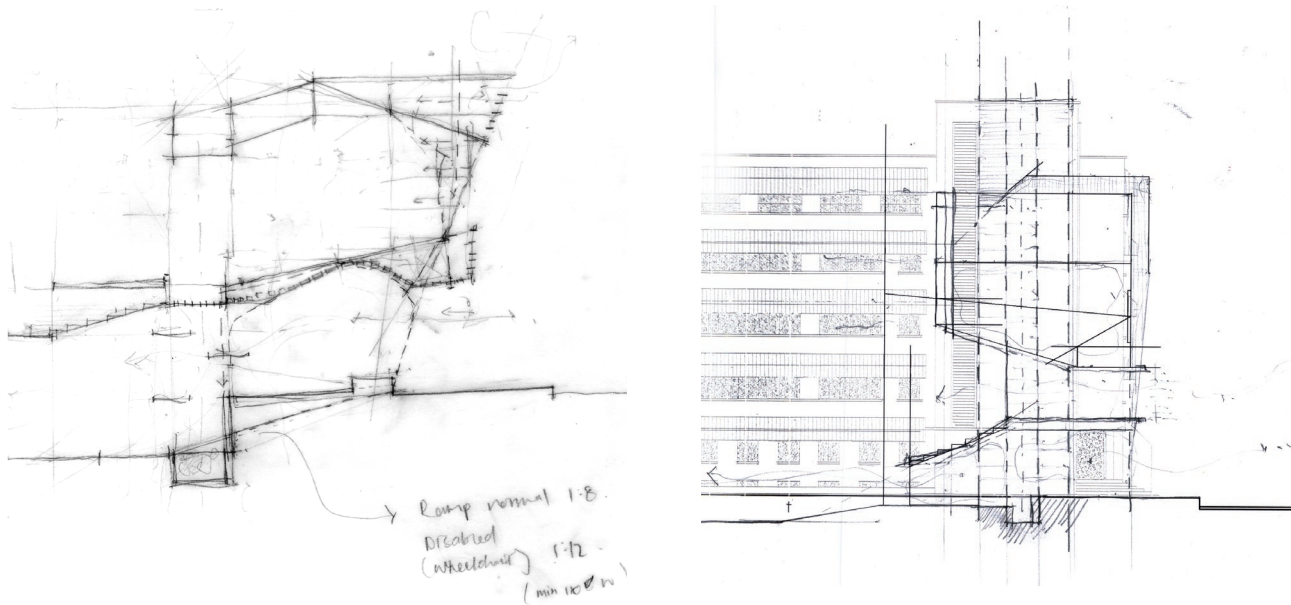


Figure 7.17 illustrates a further sectional development of the internal and external edge conditions through the extended landscape sunken below street level, continuously becoming the boundary wall to the structural and service spine that extends throughout the building and facilitates public circulation ramps to higher levels. (Author 2015)

To be drawn

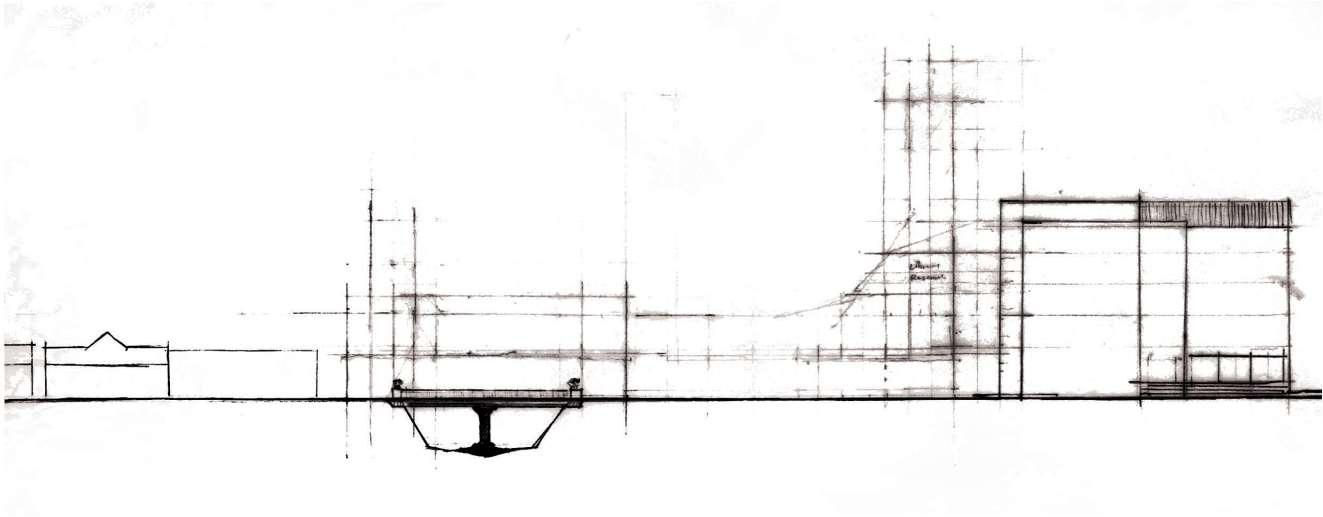


Figure 7.18 illustrates a first translation of the section and plan to elevation, considering an appropriate spatial and formal translation between the mass and scale of the adjacent buildings . (Author 2015)

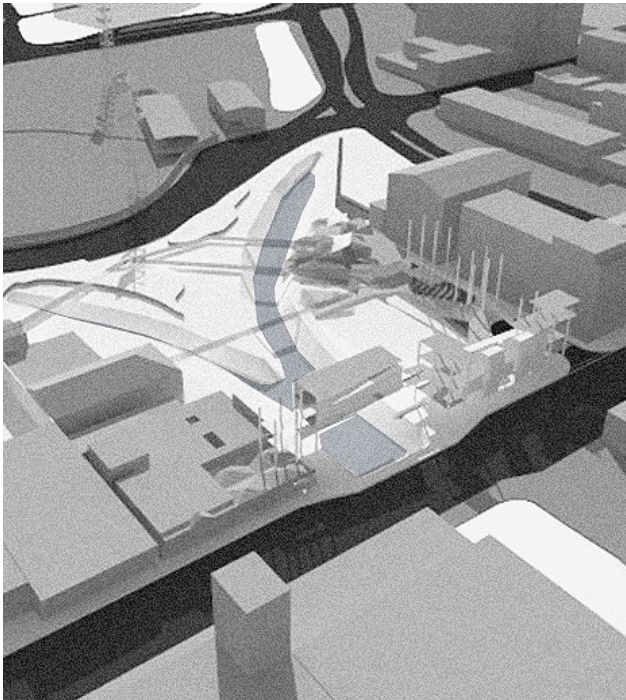


Figure 7.19: Northern birds eye view perspective drawing of the structural, formal and spatial development during iteration 2. (Author 2015)



Figure 7.20: Southern birds eye view perspective drawing of the structural, formal and spatial development during iteration 2. (Author 2015)

7.2.3

Iteration 3:

Development of the water system and structural core

Iteration 3 is discussed as a development of the main conceptual intentions as determined and discussed in the first two iterations, and focusses on the development of refining the water system, and on the structural and service spine as spatial agent, influencing the development of the activities it services and both the internal and external edge responses.

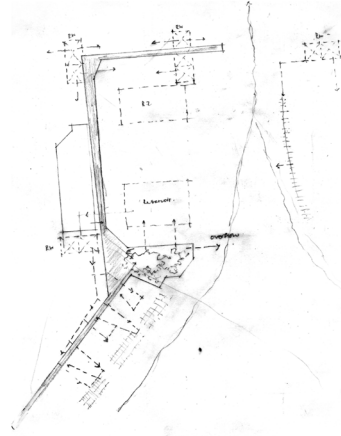


Figure 7.21: Conceptual diagramme of the development of the constructed water channel and landscape. (Author 2015)



Figure 7.22: Site parti diagramme illustrating the intentions of iteration 2 as a reconstructed artificial landscape. (Author 2015)

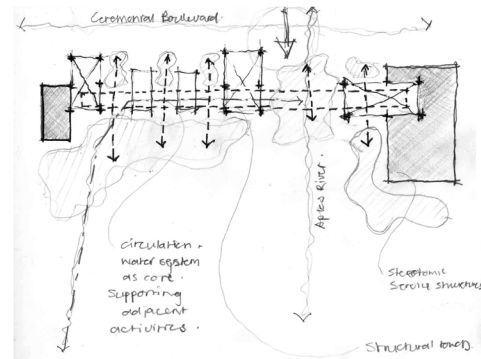


Figure 7.23: The building parti diagramme illustrating the intentions of the structural towers, circulation and water channel becoming the structural core and supporting adjacent activities. (Author 2015)

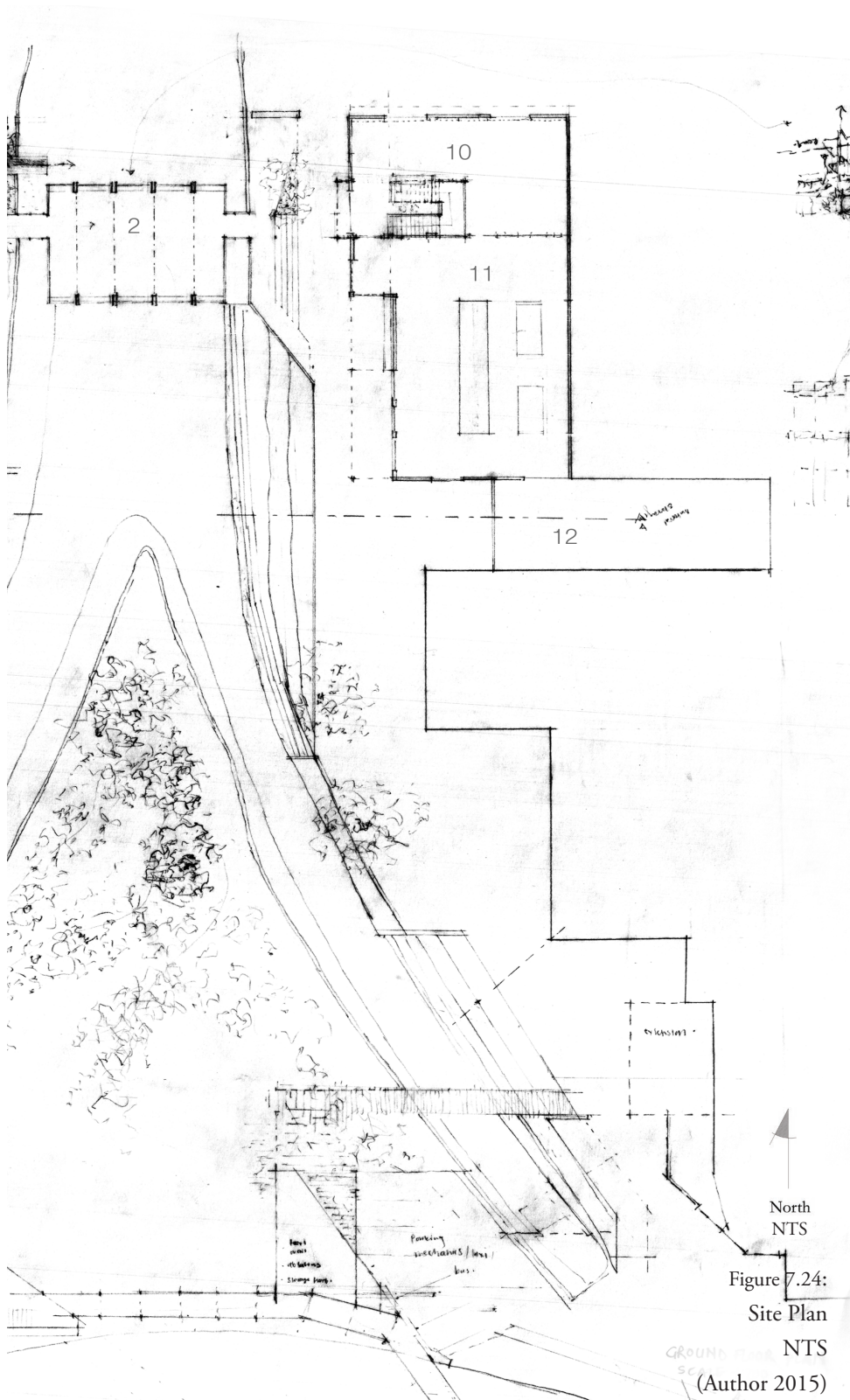
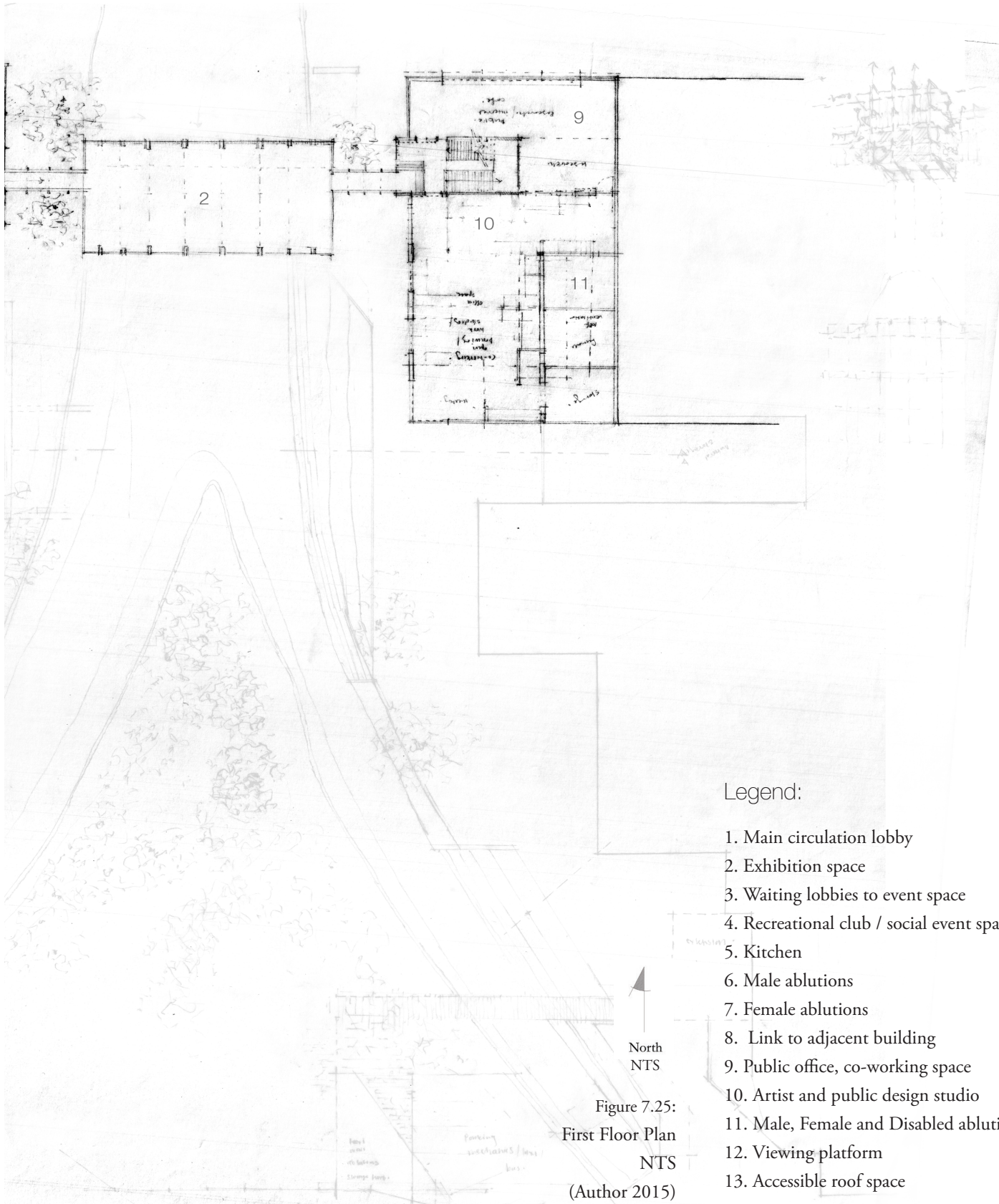


Figure 7.24 illustrate the refinement of the development of the water channel throughout the site. The position of the constructed wetland is moved to a central point along the water channel that creates a landscaped boundary between the southern edge of the public court and the transition to the horticulture workshop and landscaped park bordering the channel. The repositioning of the water channel and constructed wetland, along with the position of the public swimming pool, enables more recreational opportunities along the water channel.

Legend:

1. Main entrance and circulation lobby
2. Entrance lobby and visitor's information centre
3. Market space with lockable storage
4. Recreational social club and event space
5. Kitchen
6. Male ablutions and changing rooms, Disabled abluion
7. Outdoor public sports court
8. Public swimming pool
9. Female ablutions and changing rooms
10. Retail space: Artist furniture, sculptural and installation art
11. Artist and public workshop
12. Material Storage and collection point from site
13. Greenhouses
14. Horticulture workshop
15. Proposed future development: Restaurant and Student Centre

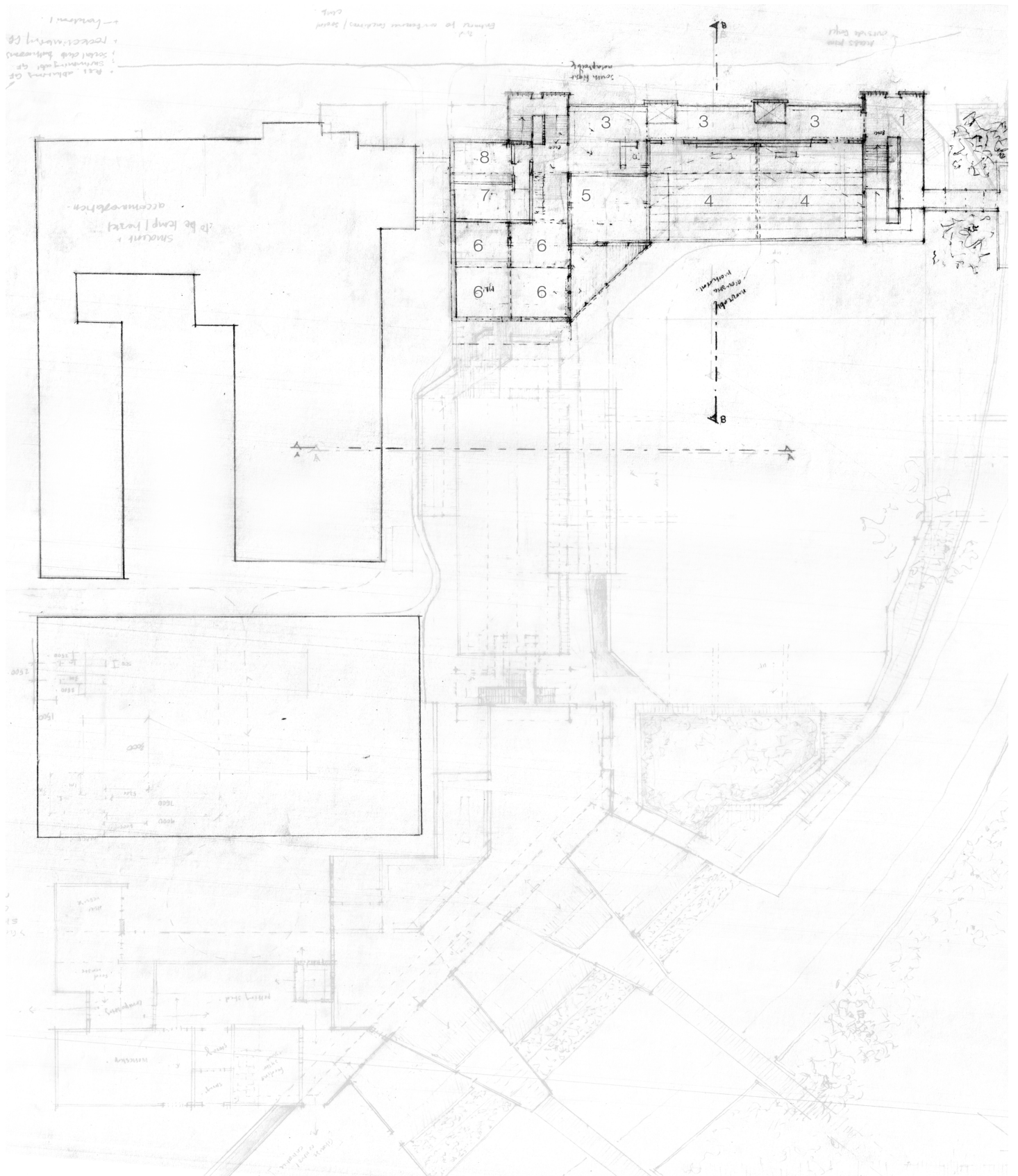
Figure 7.24:
Site Plan
NTS
(Author 2015)

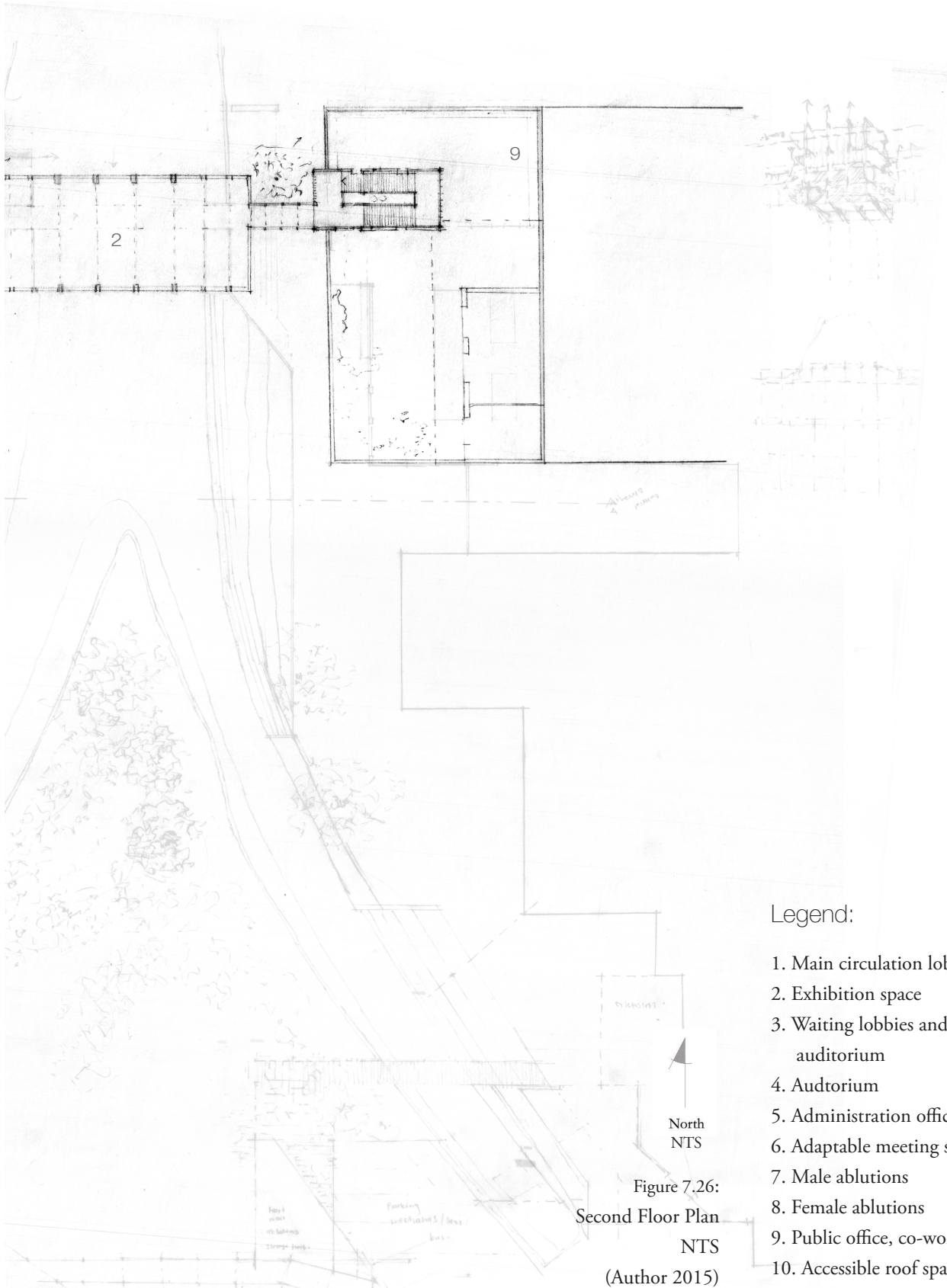


Legend:

1. Main circulation lobby
2. Exhibition space
3. Waiting lobbies to event space
4. Recreational club / social event space
5. Kitchen
6. Male ablutions
7. Female ablutions
8. Link to adjacent building
9. Public office, co-working space
10. Artist and public design studio
11. Male, Female and Disabled ablutions
12. Viewing platform
13. Accessible roof space

Figure 7.25:
First Floor Plan
NTS
(Author 2015)





Legend:

1. Main circulation lobby
2. Exhibition space
3. Waiting lobbies and reception to auditorium
4. Auditorium
5. Administration office
6. Adaptable meeting spaces
7. Male ablutions
8. Female ablutions
9. Public office, co-working space
10. Accessible roof space

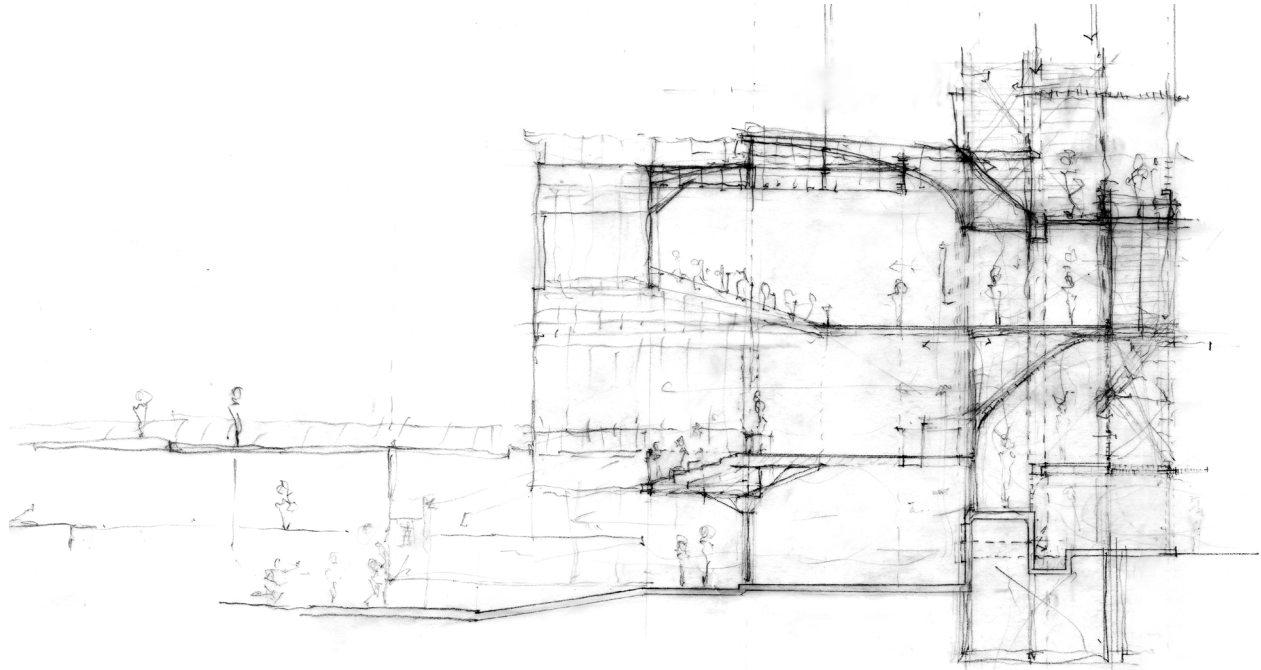


Figure 7.28: Development of section a-a during iteration 3, as a response to site activities, the sculpted landscape as well as water processes along the building and site. (Author 2015)

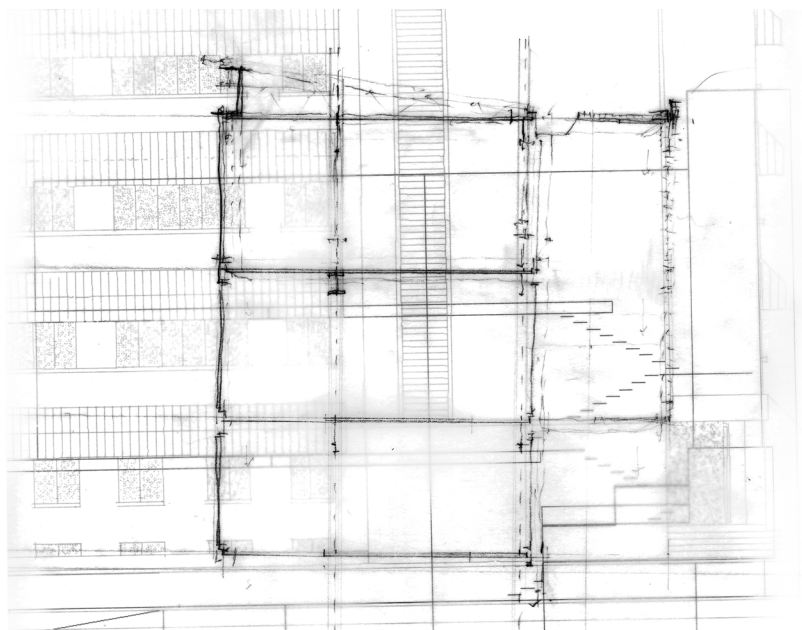
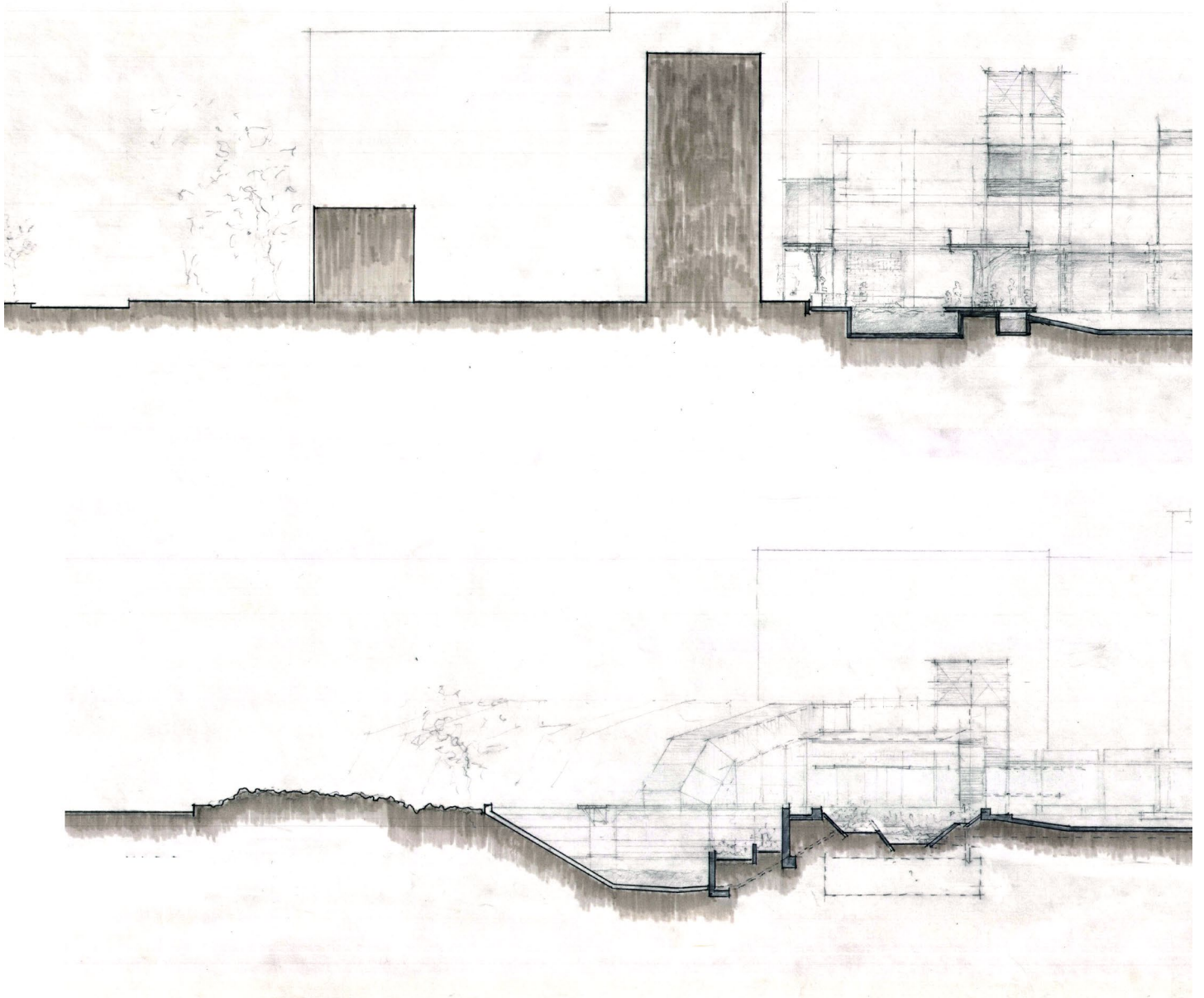


Figure 7.29: Diagrammatic section of the water processes along the roof and ground level as informant to the sectional development of the structural and service spine of the building. (Author 2015)



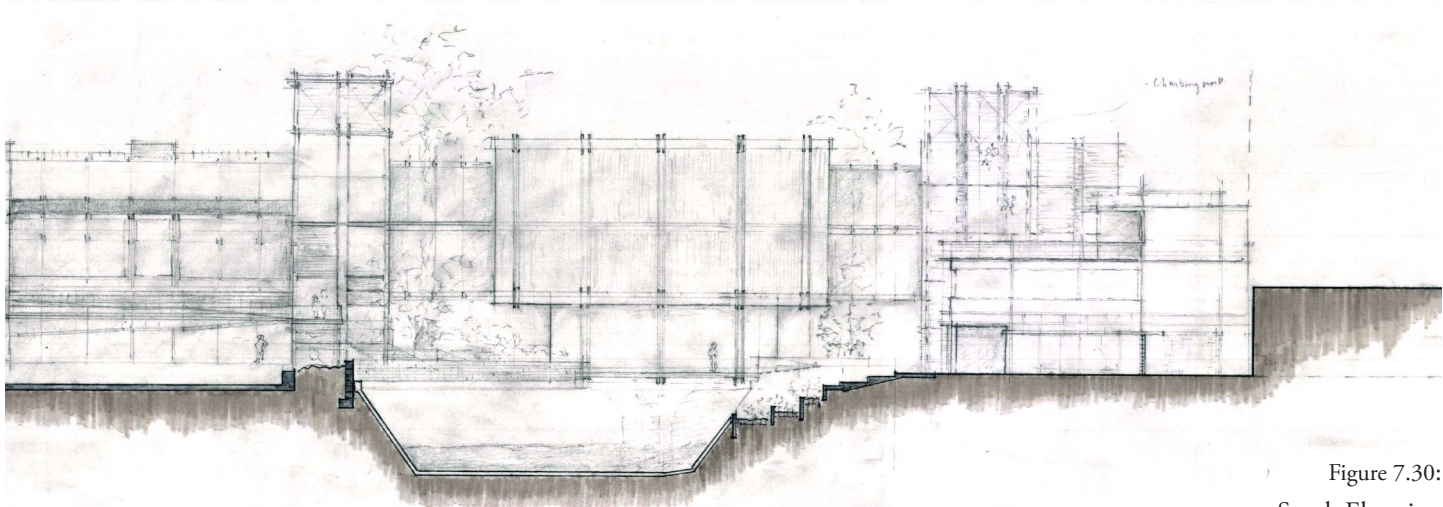


Figure 7.30:
South Elevation
NTS
(Author 2015)

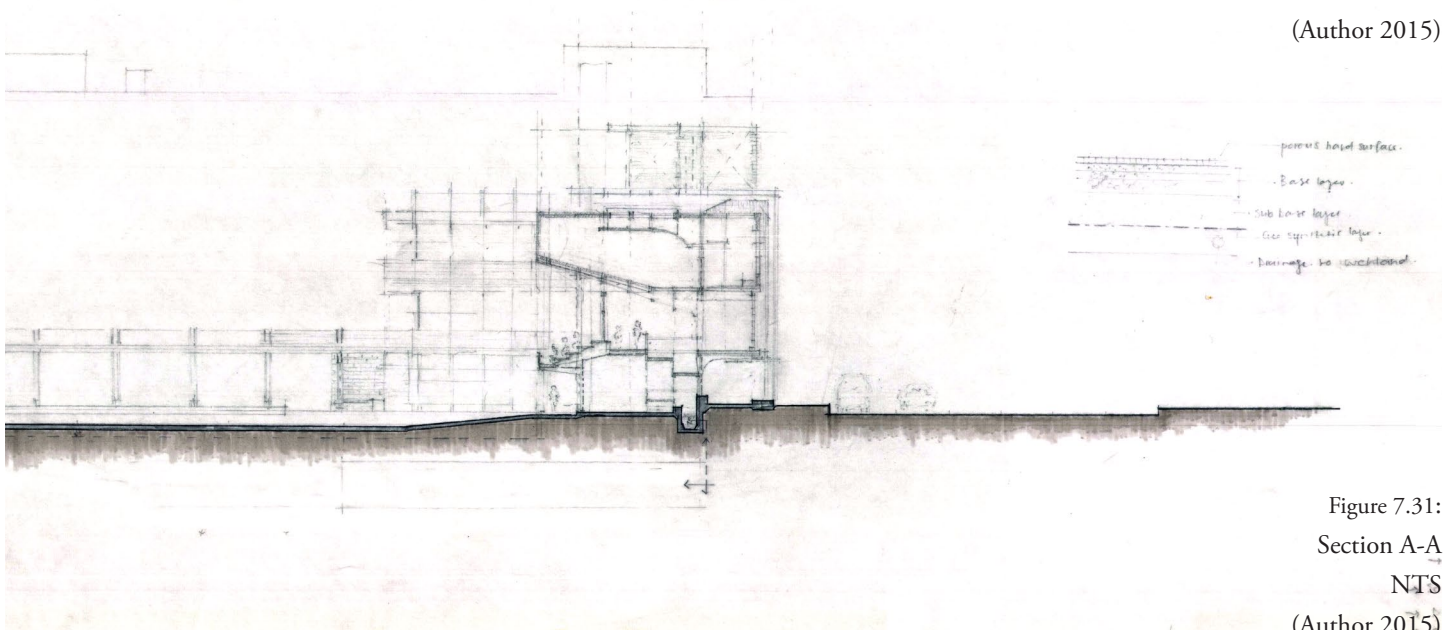


Figure 7.31:
Section A-A
NTS
(Author 2015)

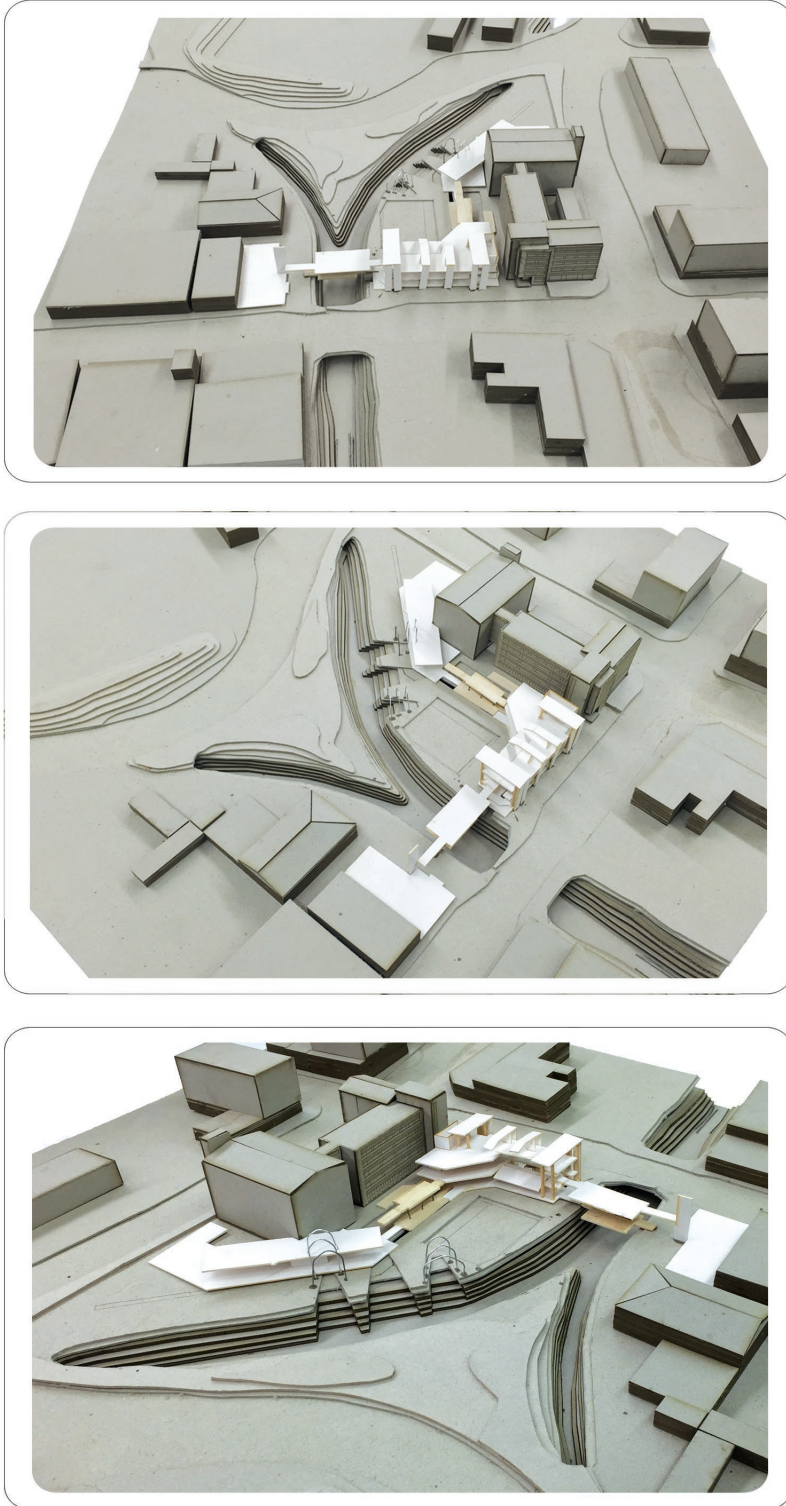


Figure 7.32: Photographs of model development during iteration 3
(Author 2015)

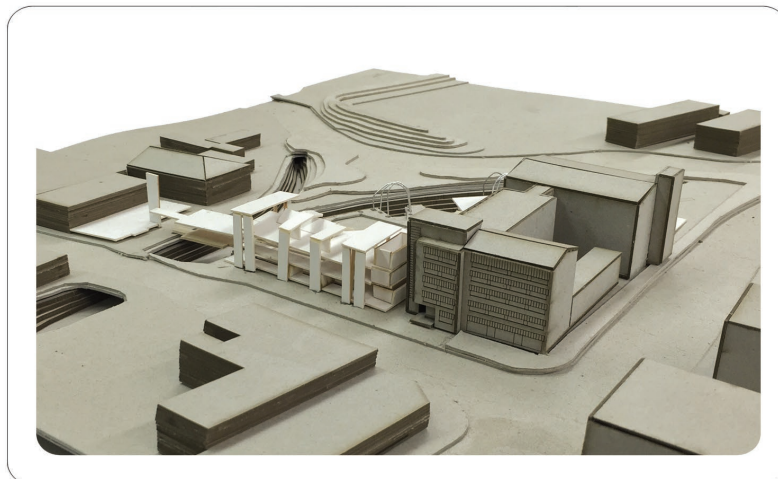
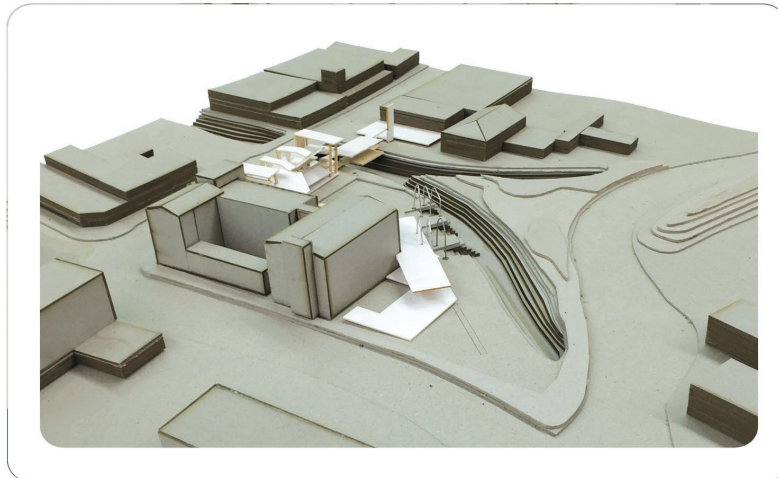


Figure 7.33: Photographs of model development during iteration 3.
(Author 2015)

7.2.4

Iteration 4:

Development of the structural and service core influencing the external edge response

B

Structural and service spine

The development of iteration four focussed on the emphasis of the structural and service core of the building as unifying entity establishing a continuity in the reading of its horizontal nature on all plans, as well as its vertical continuity as read throughout all sections of the building. Figure 7.34 as building parti diagramme illustrates the main conceptual developments of iteration four. Figure 7.35 as sectional diagramme illustrates the significance of the continuous landscape becoming the structural and service core, supporting the internal and external edge conditions.

The uniformity of the architectural language of the structural core towers on façade and plan becomes integral to the continuity of the building. (See Figure 7.36)

The stereotomic boundary structure as an extension of the sculpted landscape is emphasised through a continuous concrete wall containing internal activities, while simultaneously expressing the structural spine at ground level. The discontinuity of the wall at the channel aims to emphasise the significance of the contextual response to Lion Bridge and the channel axis. The main entrance adjacent to the channel is emphasised through the concrete wall continuing behind the tower, exposing the open entrance through the ground level steel structure. (See Figure 7.34 and Figure 7.37 to Figure 7.44)

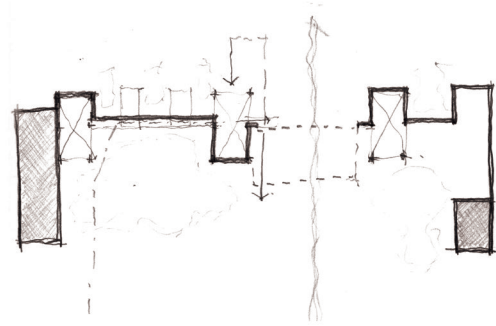


Figure 7.34: Plan parti diagramme illustrating the conceptual intentions of the development of the structural core as horizontal continuous element throughout the building. (Author 2015)

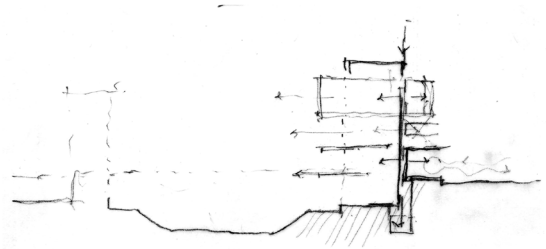


Figure 7.35: Sectional diagramme illustrating the conceptual intentions of the development of the structural core as vertical continuous element throughout the building. (Author 2015)

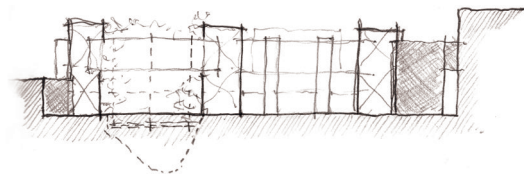


Figure 7.36: Conceptual diagramme of the elevation development in iteration 4. (Author 2015)

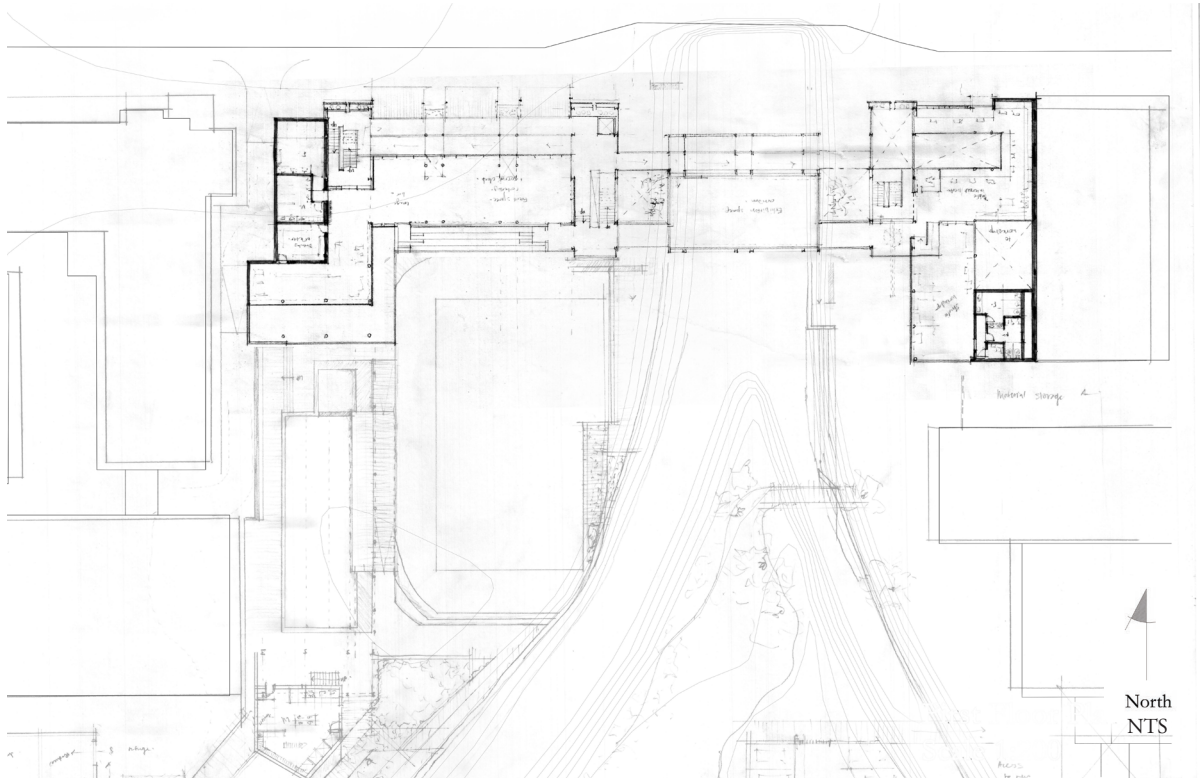


Figure 7.38: First floor plan development during iteration four. (Author 2015)

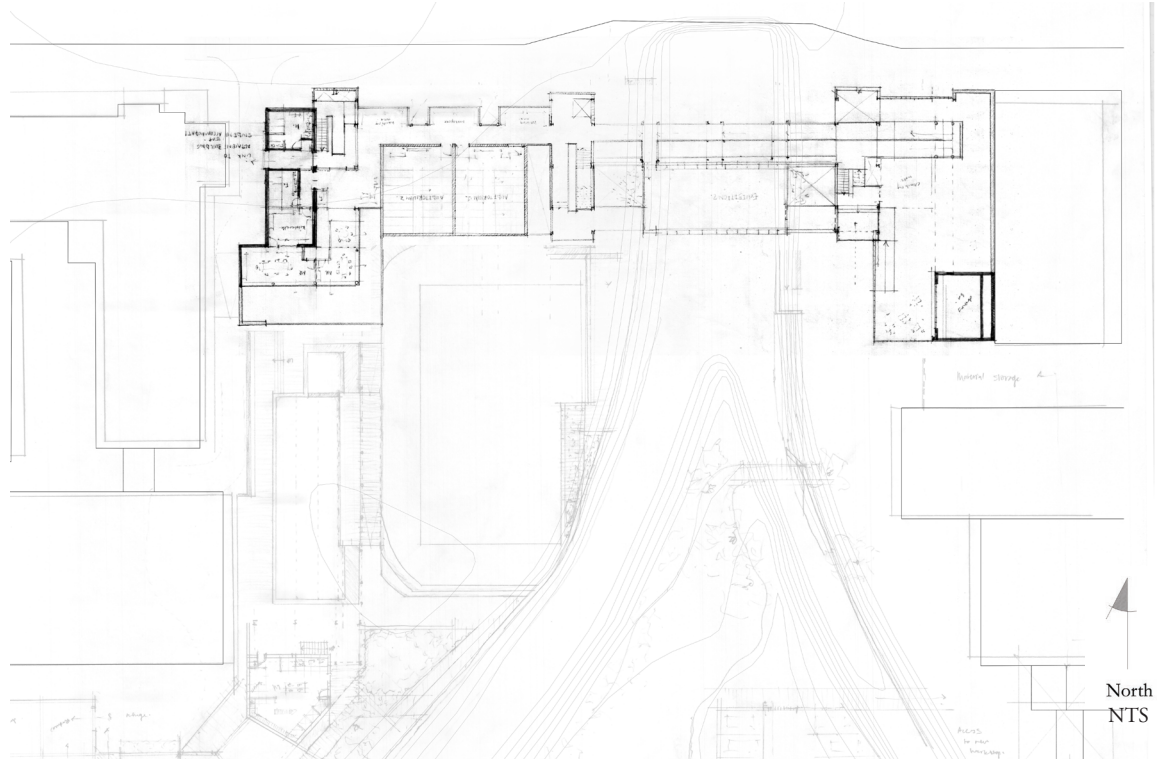


Figure 7.39: Second floor plan development during iteration four. (Author 2015)

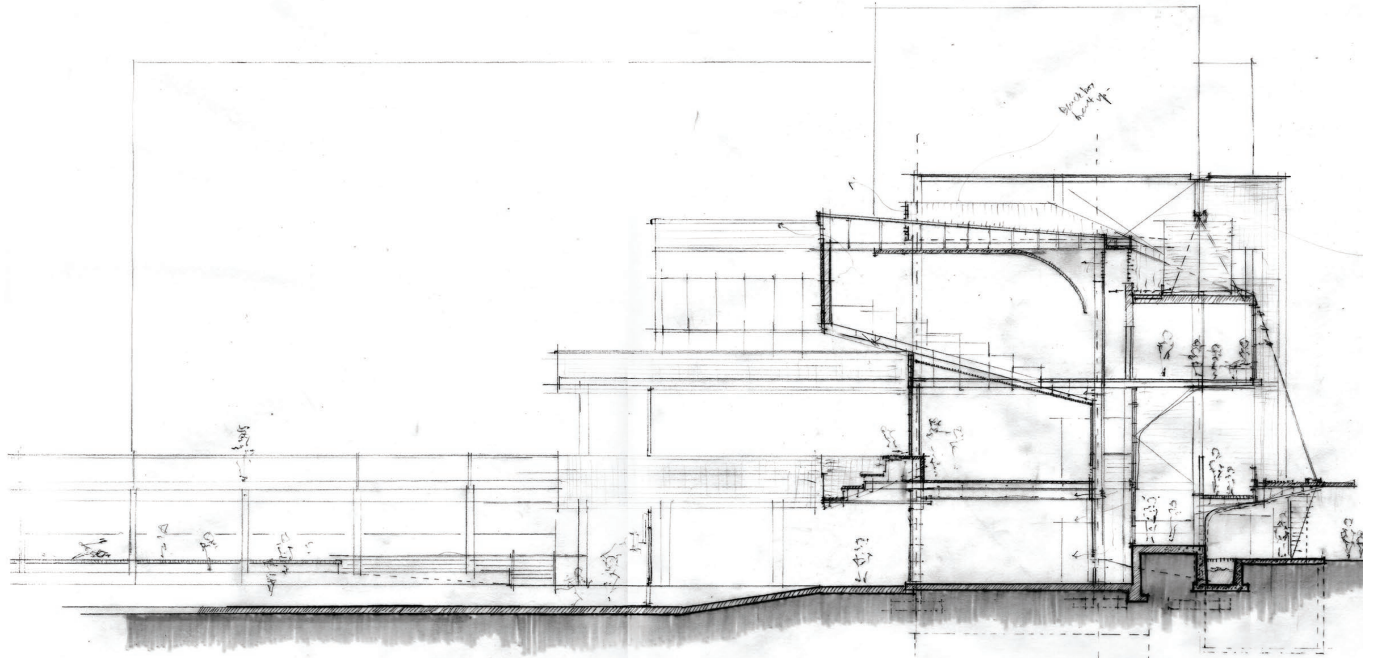


Figure 7.41:
Section A-A
NTS
(Author 2015)

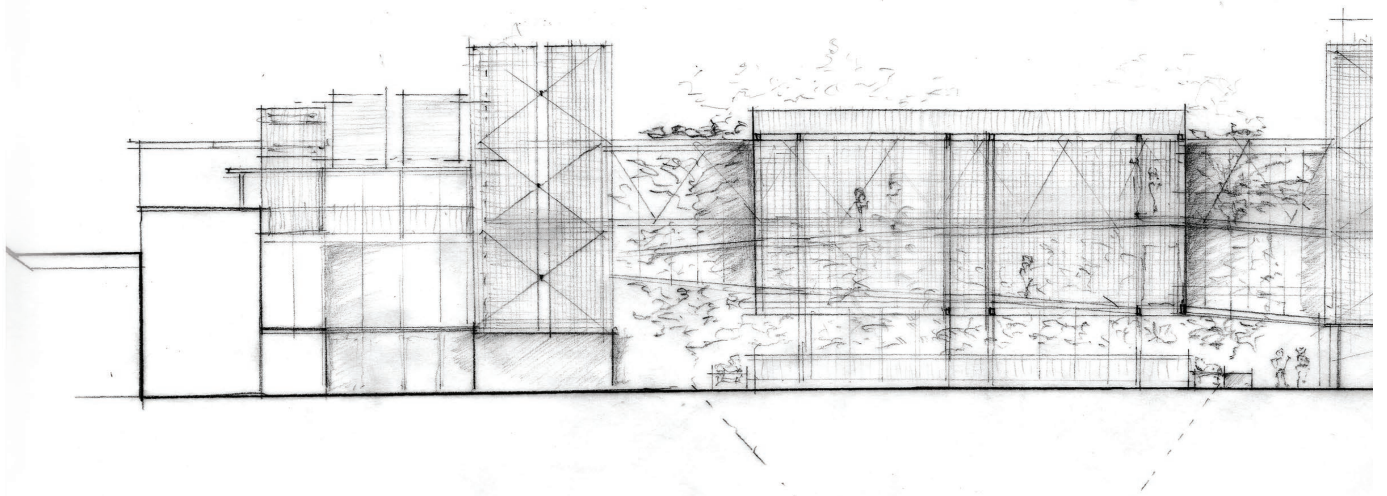


Figure 7.41, Figure 7.42 and Figure 7.43: The horizontal circulation throughout the building is moved from the structural spine to the external façade as an extension of the public street activities throughout the extent of the building, spanning the channel and animating the façade through an activated 'skin'. Access points along the route into spaces on the first and second floors are identified.

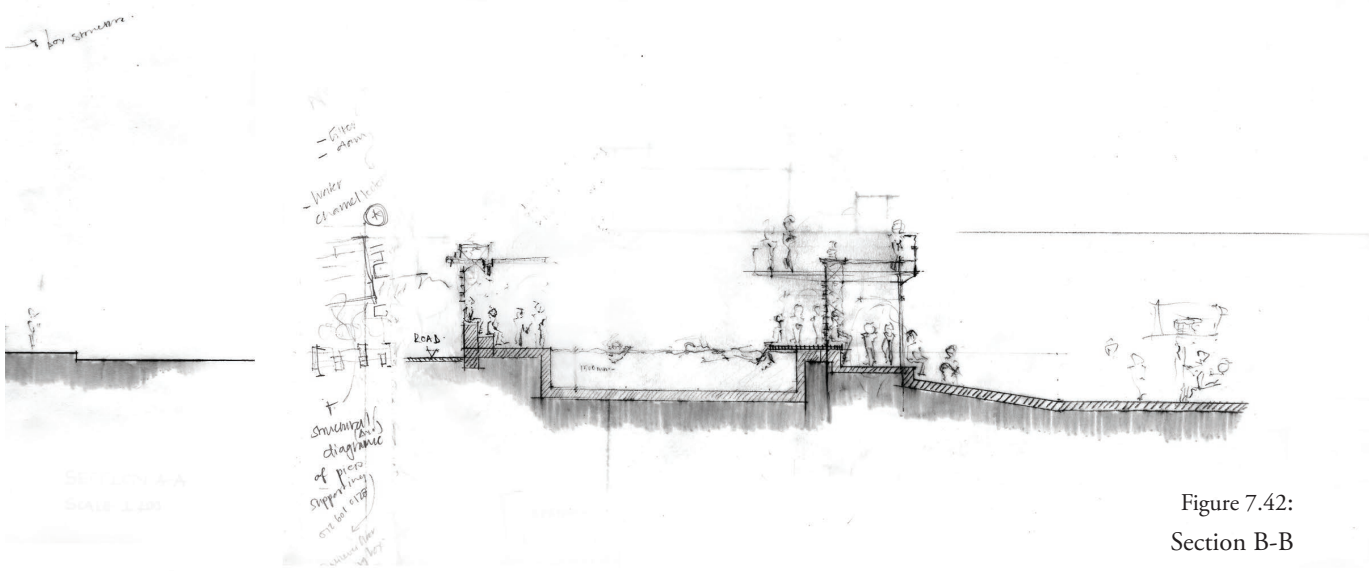


Figure 7.42:
Section B-B
NTS
(Author 2015)

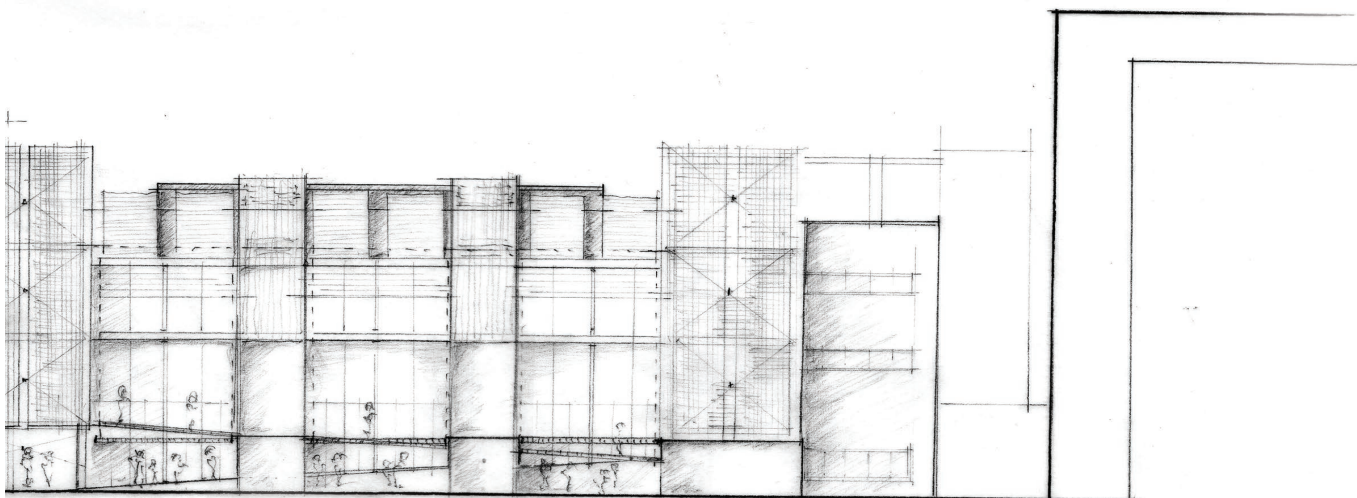


Figure 7.43:
North Elevation
NTS
(Author 2015)

7.2.5

Iteration 5:

Developing the internal spatial conditions through a refinement of the main conceptual intentions

B

Structural and service spine

The final iteration synthesises the most significant design development decisions with regards to the diagrammatic conceptual components, and extends the discussion of the various developments towards their spatial implications, with the aim to address the architectural intentions and research questions set out in the introduction.

Figure 7.45 to Figure 7.47 illustrate the final development of the structural and service spine through an emphasis on the boundary wall structure continuously extending into concrete structural fins that facilitate the services and environmental systems within the spine. These also support the internal and external adjacent spaces between the structural core towers.

The uniformity of the building and structural spine on the ground floor is extended vertically, throughout the section of the building, into a proposed lightweight roof structure as continuous entity in the language of the structure. See Figure 7.46 and Figure 7.47. The continuous roof aims to aesthetically tie the three structural core towers and the intermediate structural fins together as well as create an extension of the continuous water system at roof level, while still allowing the various building sections to respond contextually.

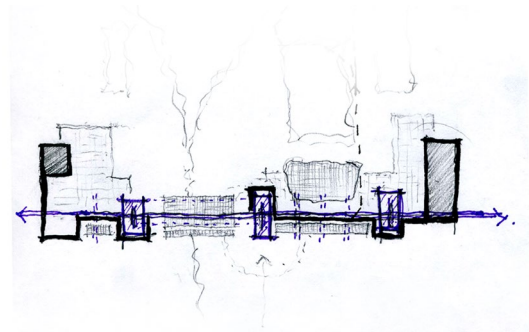


Figure 7.45: Plan parti diagramme illustrating the conceptual intentions of the development of the structural core as horizontal continuous element throughout the building

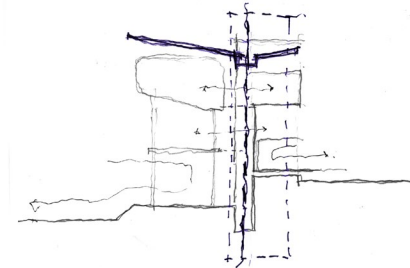


Figure 7.46: Sectional diagramme illustrating the conceptual intentions of the development of the structural core as vertical continuous element throughout the building

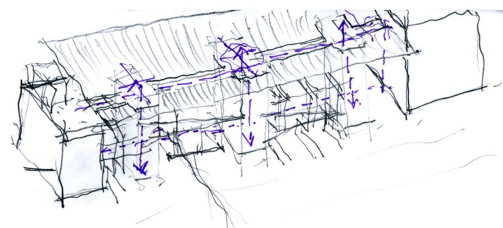


Figure 7.47: Conceptual diagramme of the elevation development in iteration 4

C
External and Internal edge response

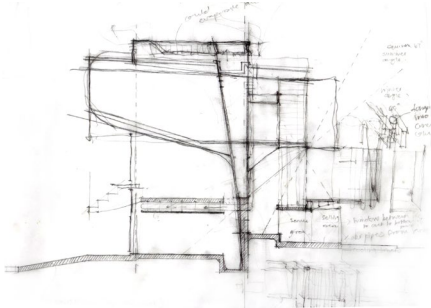


Figure 7.48: Sectional development 1 of the internal and external spatial conditions

The development of the form and space of the auditorium, according to the conceptual intentions as well as specific acoustic requirements, proposes a loose internal organisation, separated from the structural and service spine but connected through circulation bridges. This separation and loose organisation of the internal spaces articulate the placement of these structures within the contained landscape, and emphasise a vertical and horizontal spatial and visual relationship to the structural and service spine throughout all internal circulation spaces.

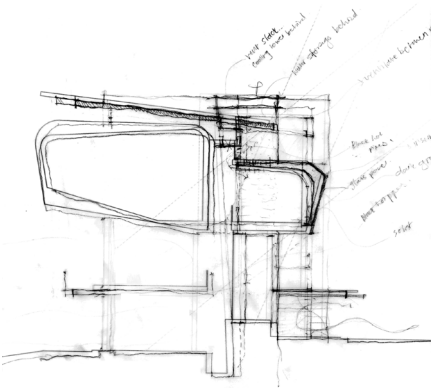


Figure 7.49: Sectional development 2 of the internal and external spatial conditions

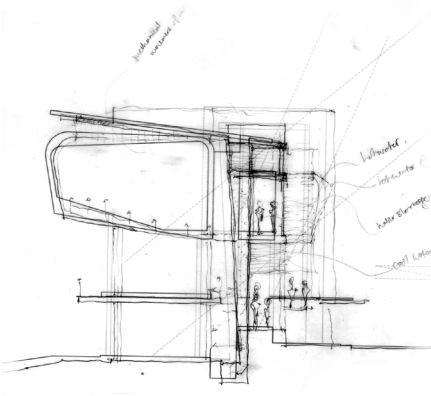
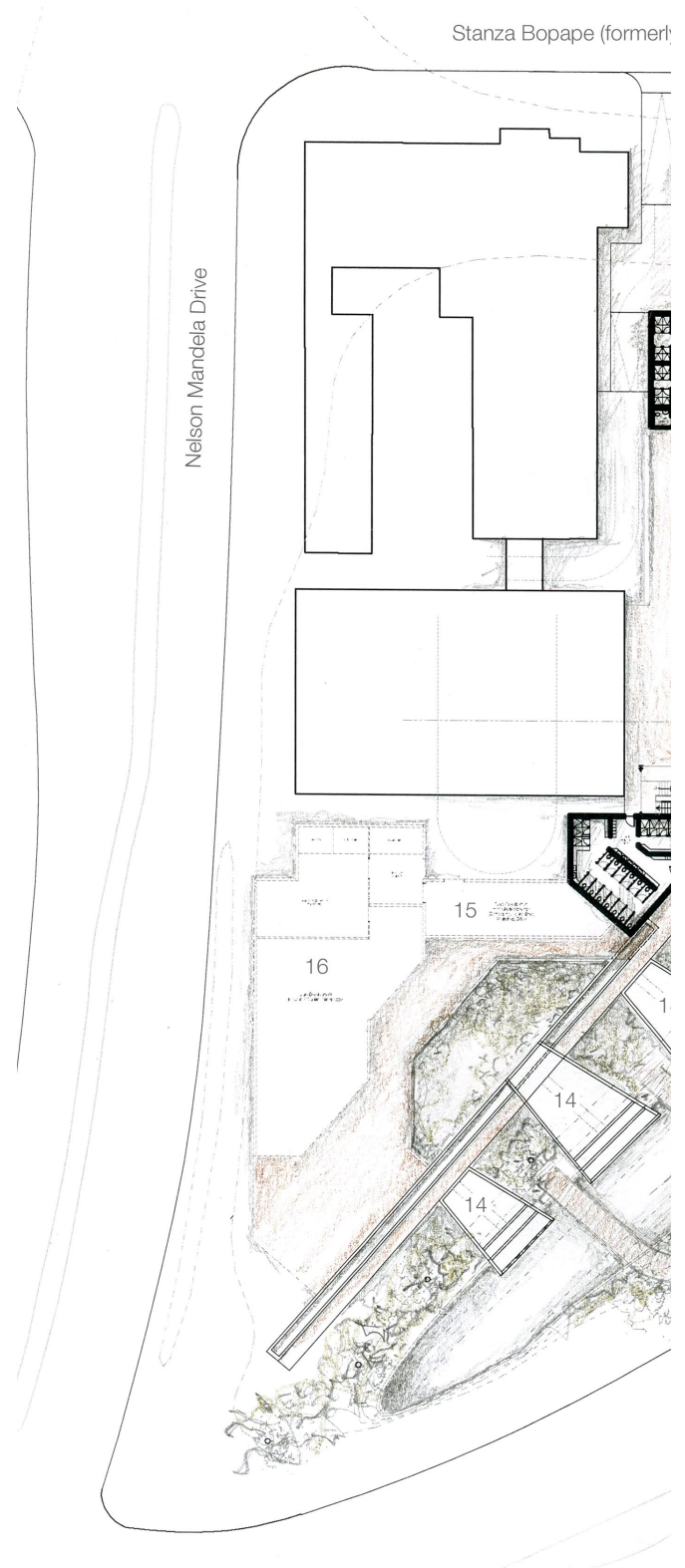


Figure 7.50: Sectional development 2 of the internal and external spatial conditions

8.2.6
Iteration 6:
Design Proposal drawings

Legend:

1. Main entrance and circulation lobby
2. Entrance lobby and visitor's information centre
3. Market space with lockable storage
4. Recreational social club and event space
5. Kitchen
6. Male ablutions and changing rooms, Disabled abluion
7. Outdoor public sports court
8. Public swimming pool
9. Female ablutions and changing rooms
10. Retail space: Artist furniture, sculptural and installation art
11. Artist and public workshop
12. Male, Female and Disabled ablutions
13. Material Storage and collection point from site
14. Greenhouses
15. Horticulture workshop
16. Proposed future development: Restaurant and Student Centre



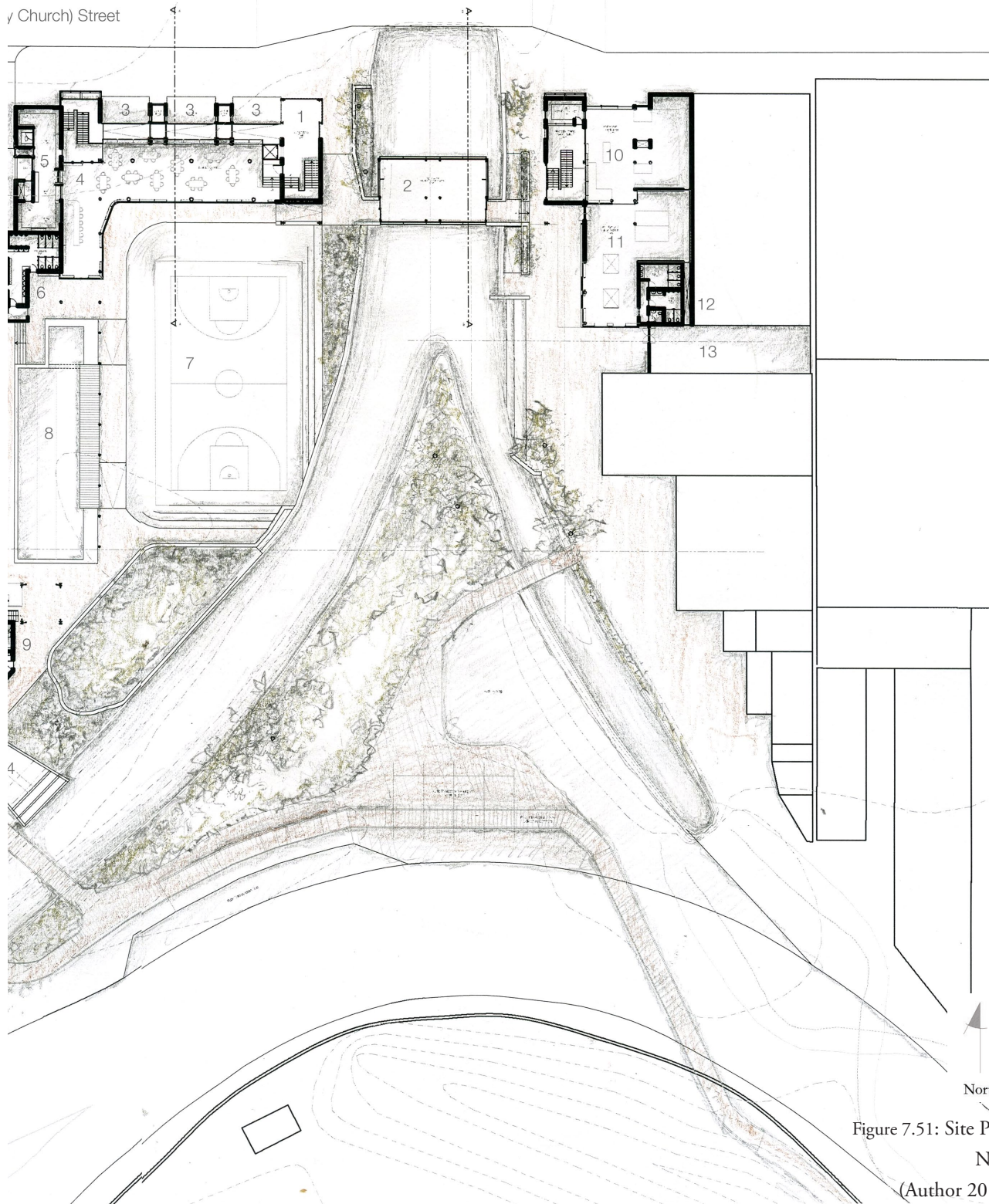


Figure 7.51: Site Plan
NTS
(Author 2015)

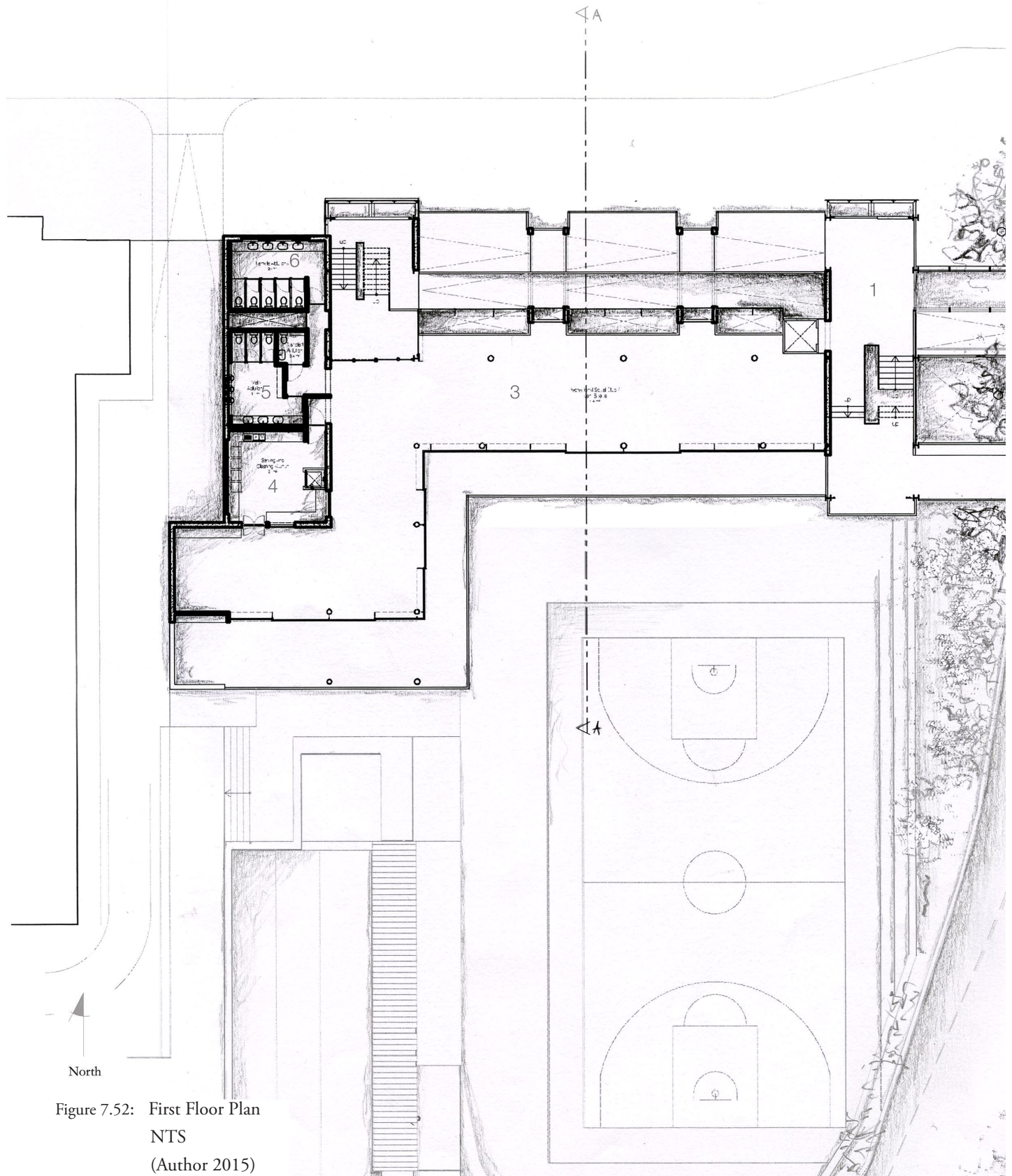
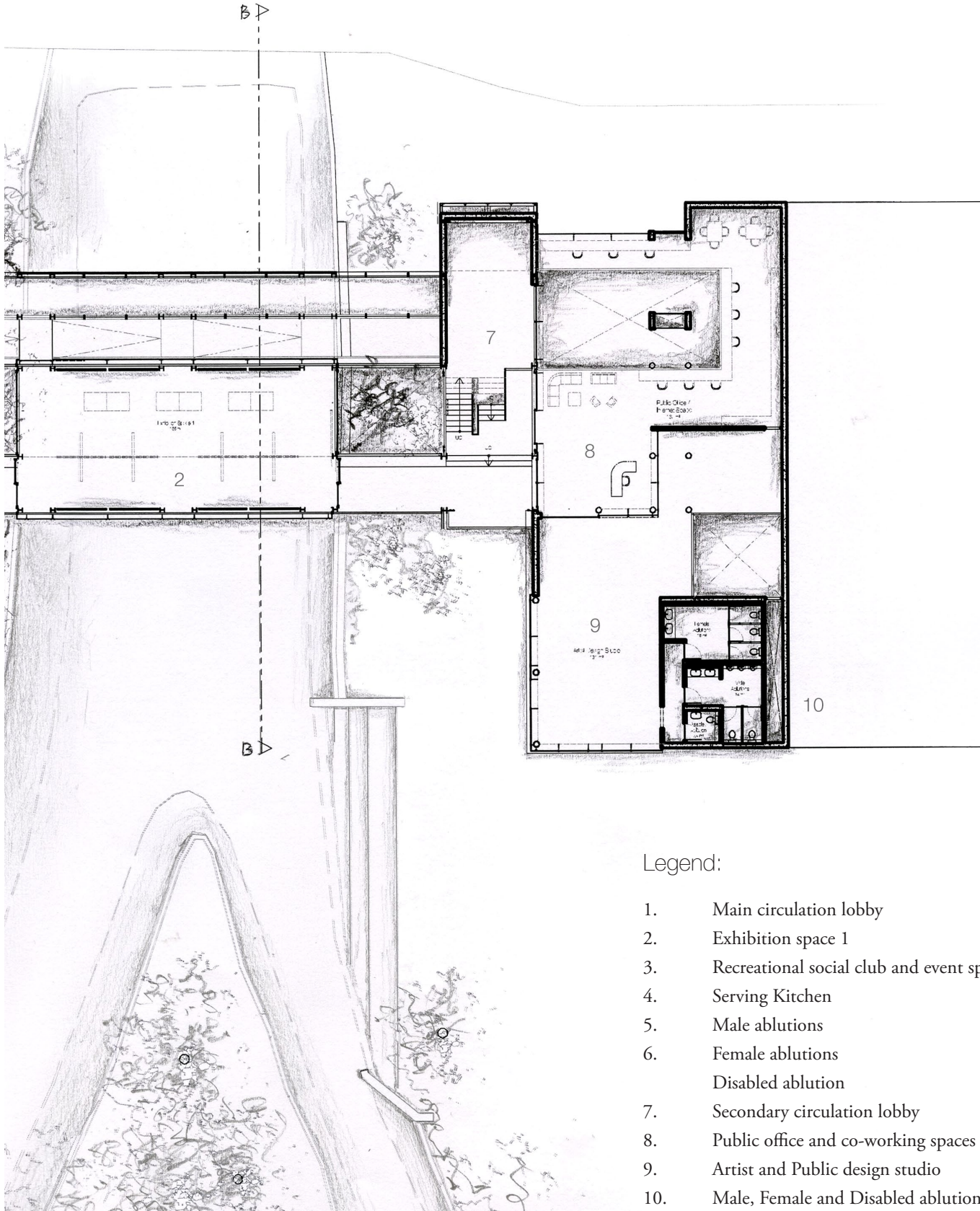


Figure 7.52: First Floor Plan
NTS
(Author 2015)



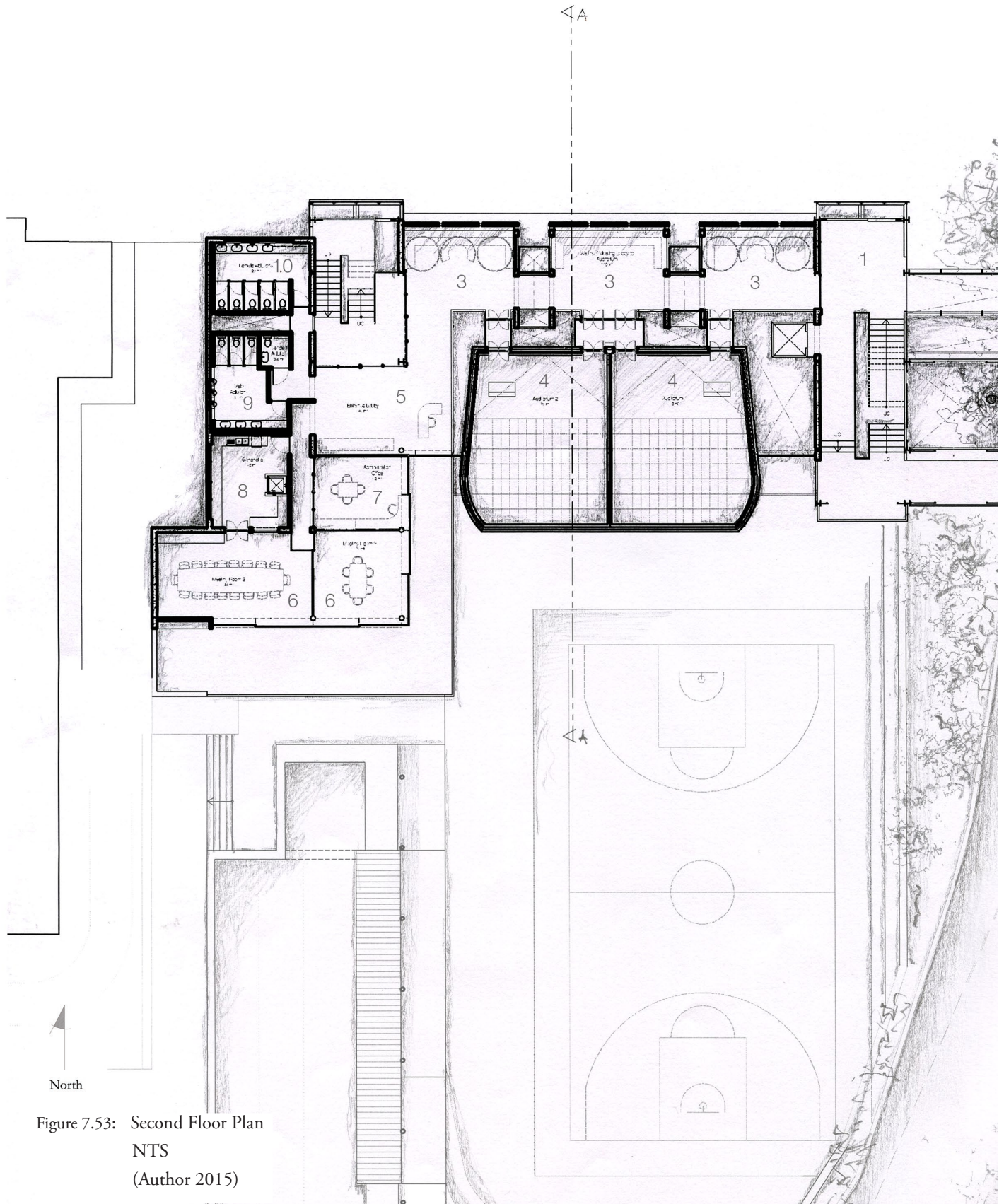
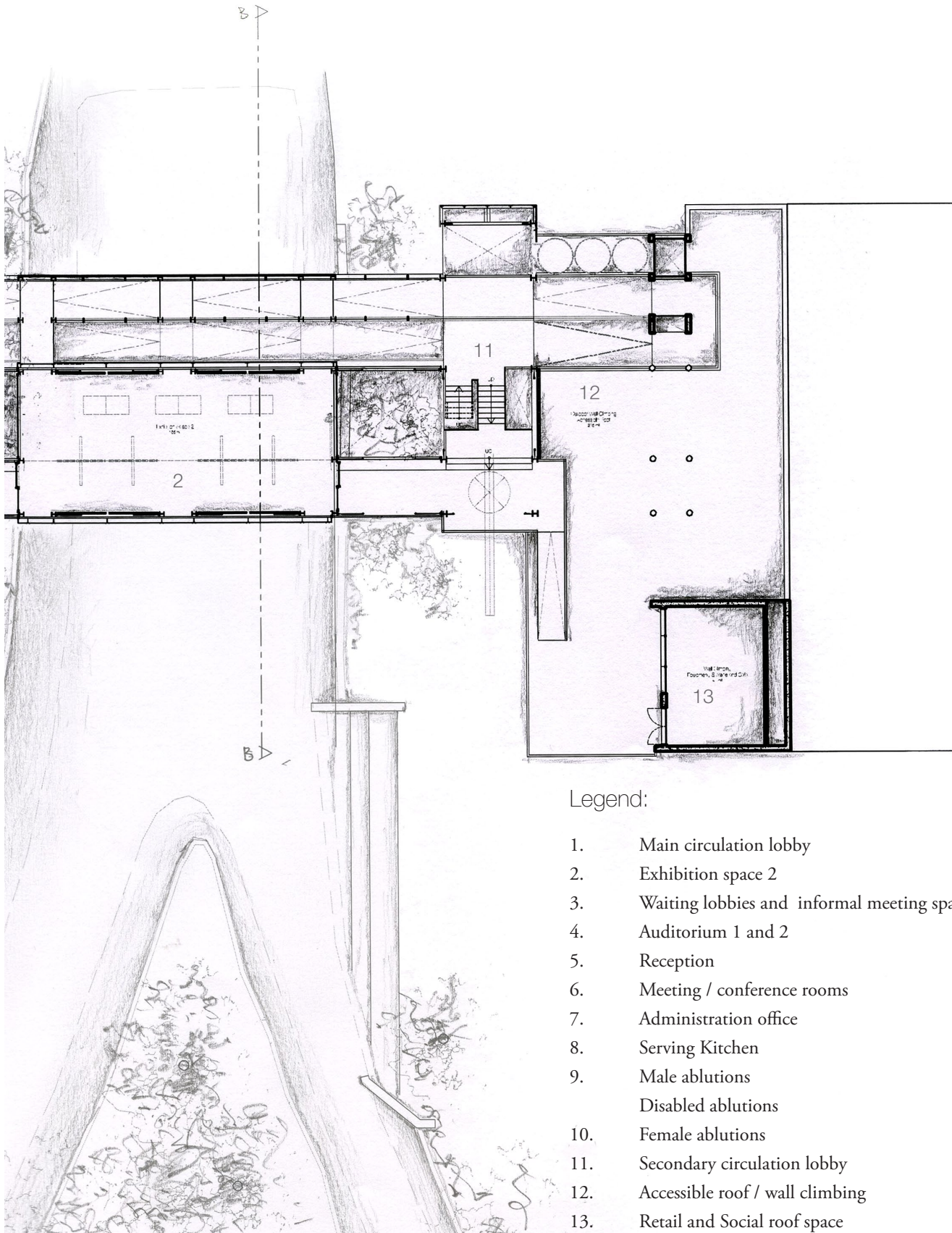
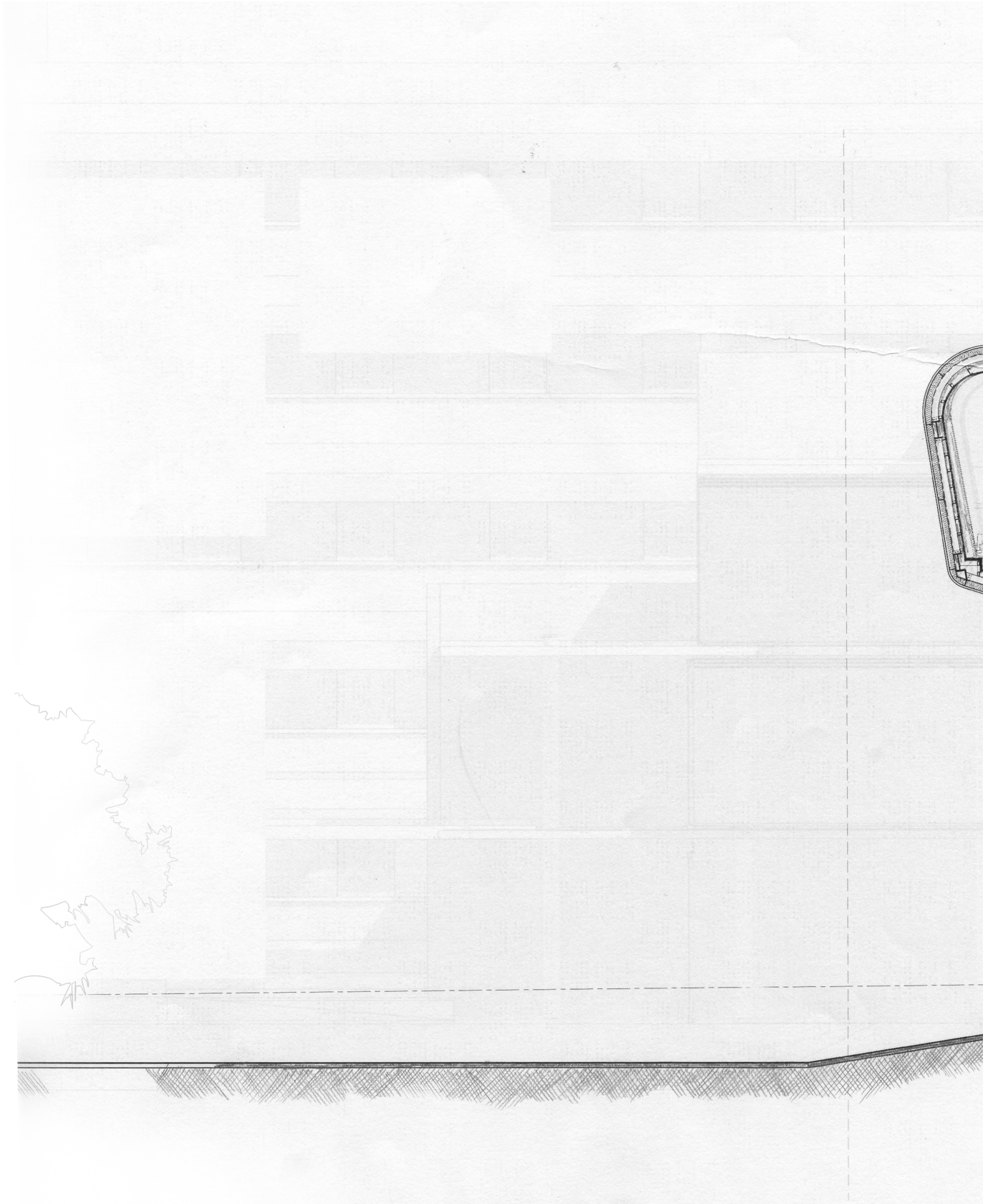


Figure 7.53: Second Floor Plan
NTS
(Author 2015)



Legend:

1. Main circulation lobby
2. Exhibition space 2
3. Waiting lobbies and informal meeting spaces
4. Auditorium 1 and 2
5. Reception
6. Meeting / conference rooms
7. Administration office
8. Serving Kitchen
9. Male ablutions
10. Disabled ablutions
11. Secondary circulation lobby
12. Accessible roof / wall climbing
13. Retail and Social roof space



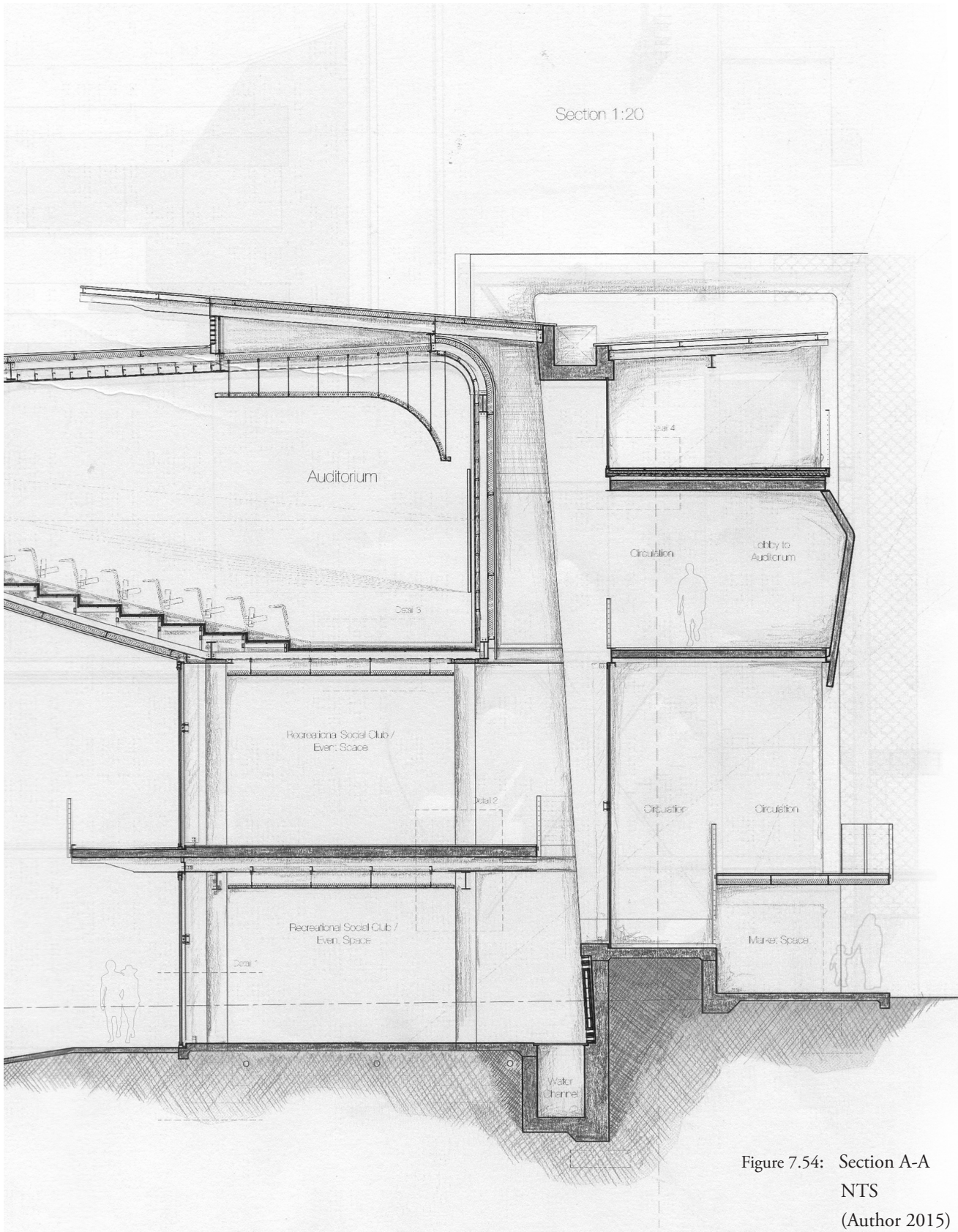


Figure 7.54: Section A-A
NTS
(Author 2015)

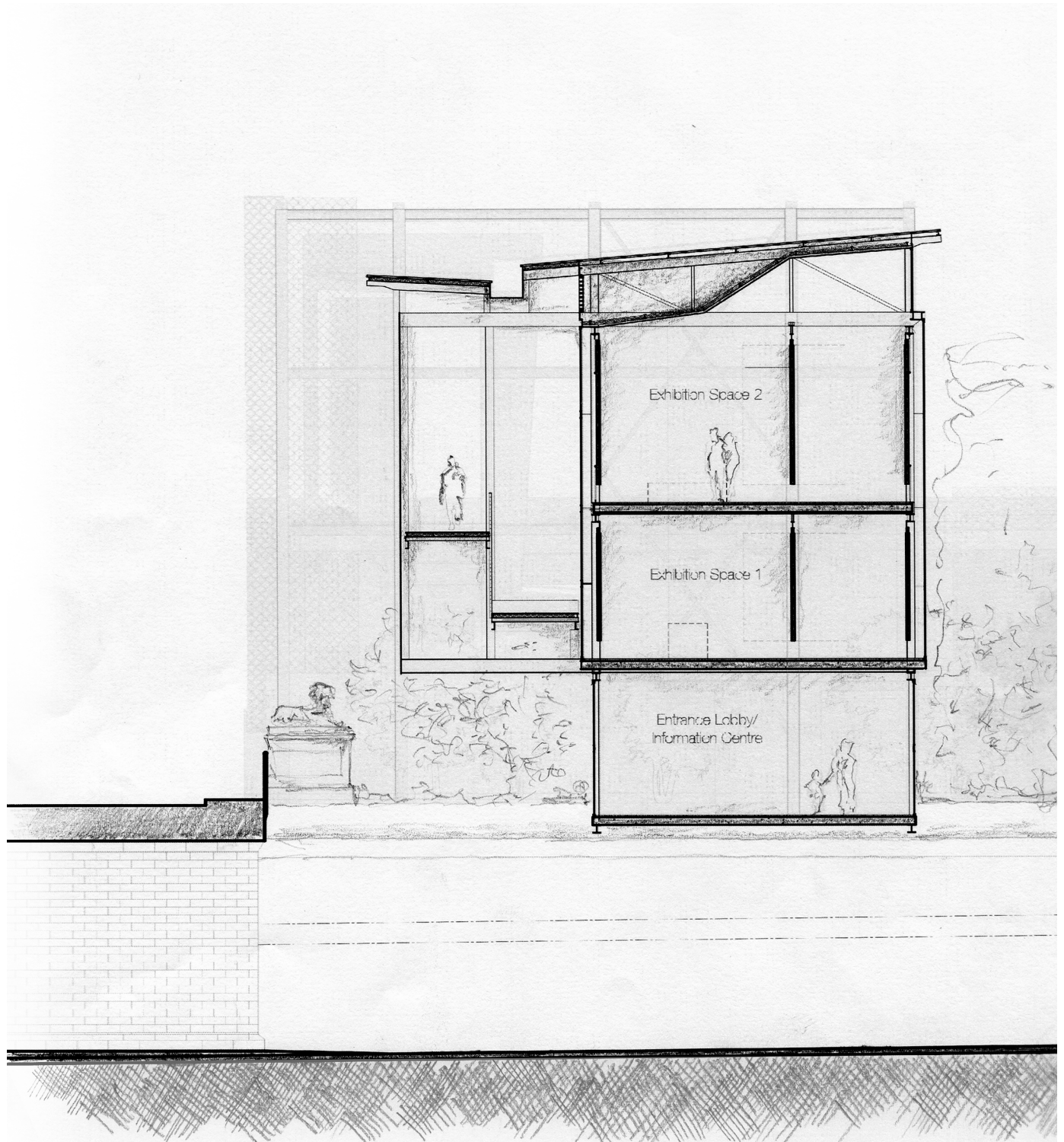
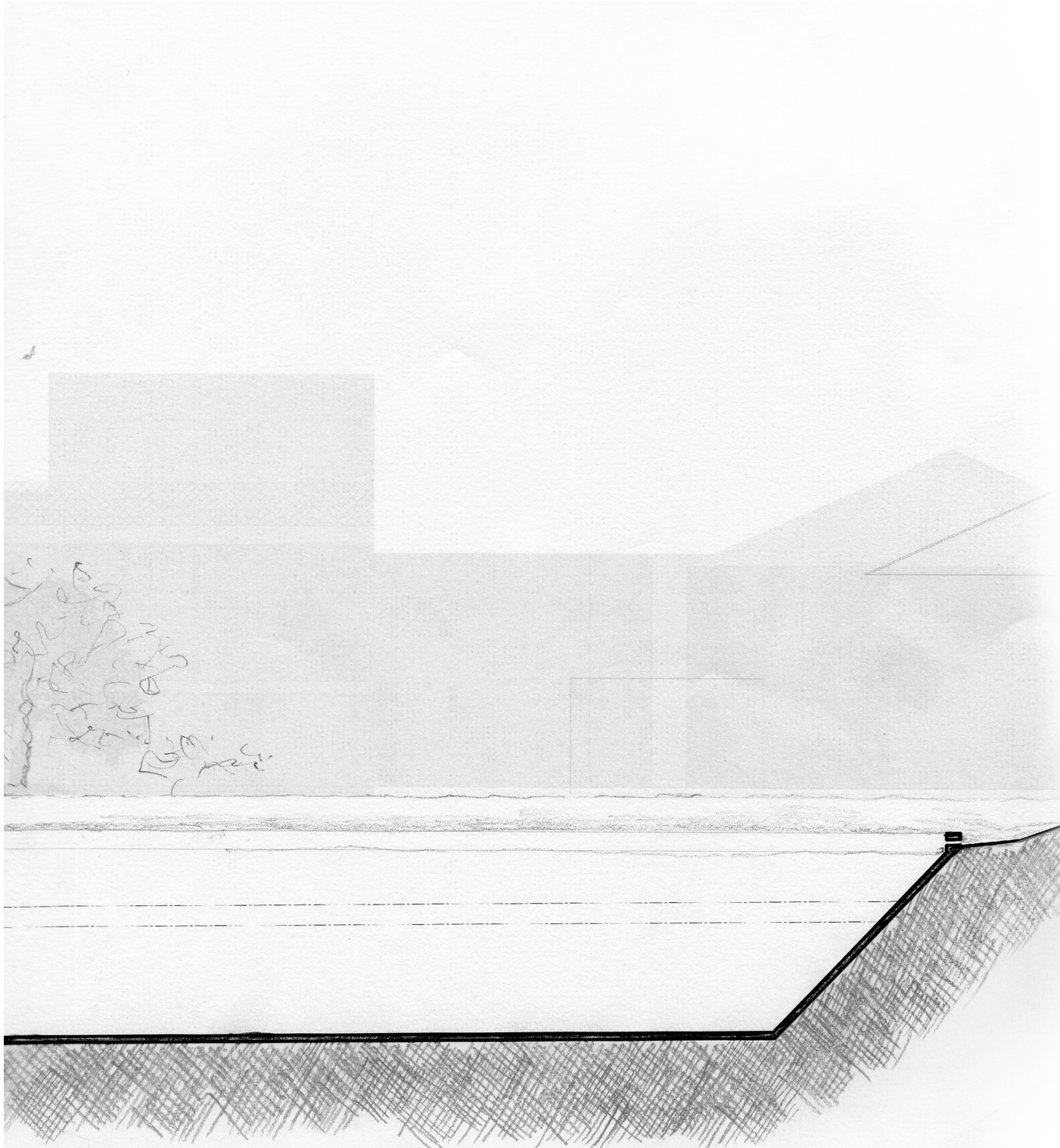
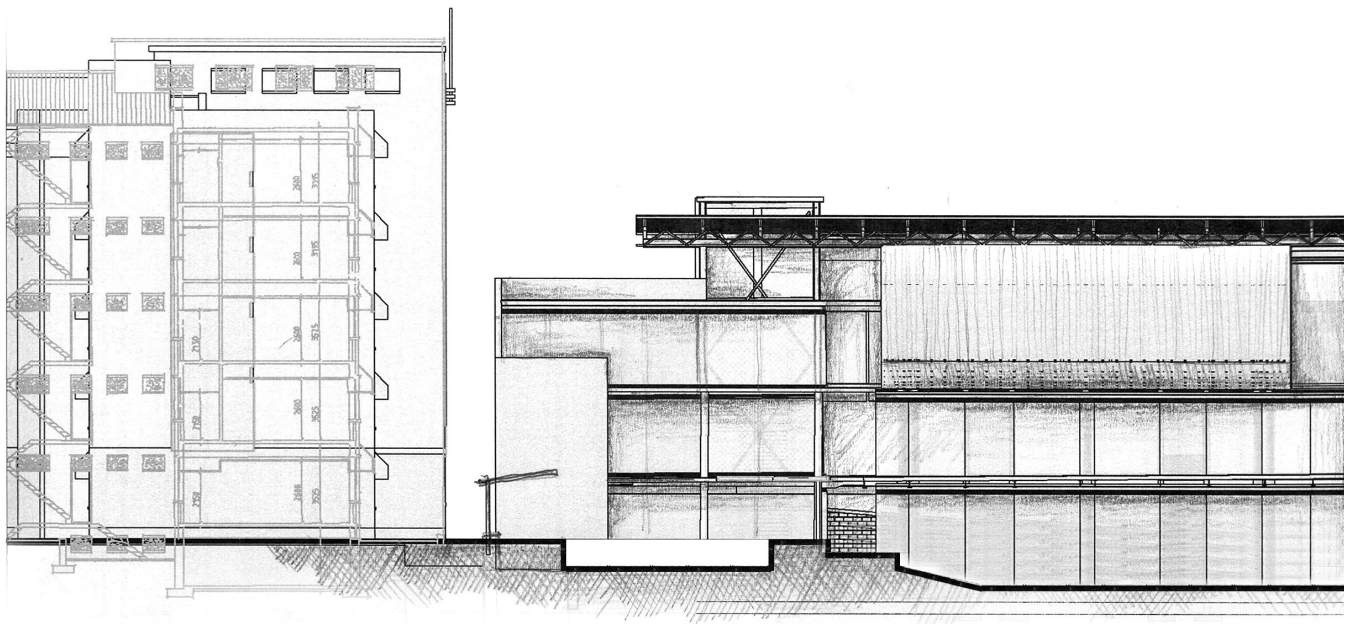
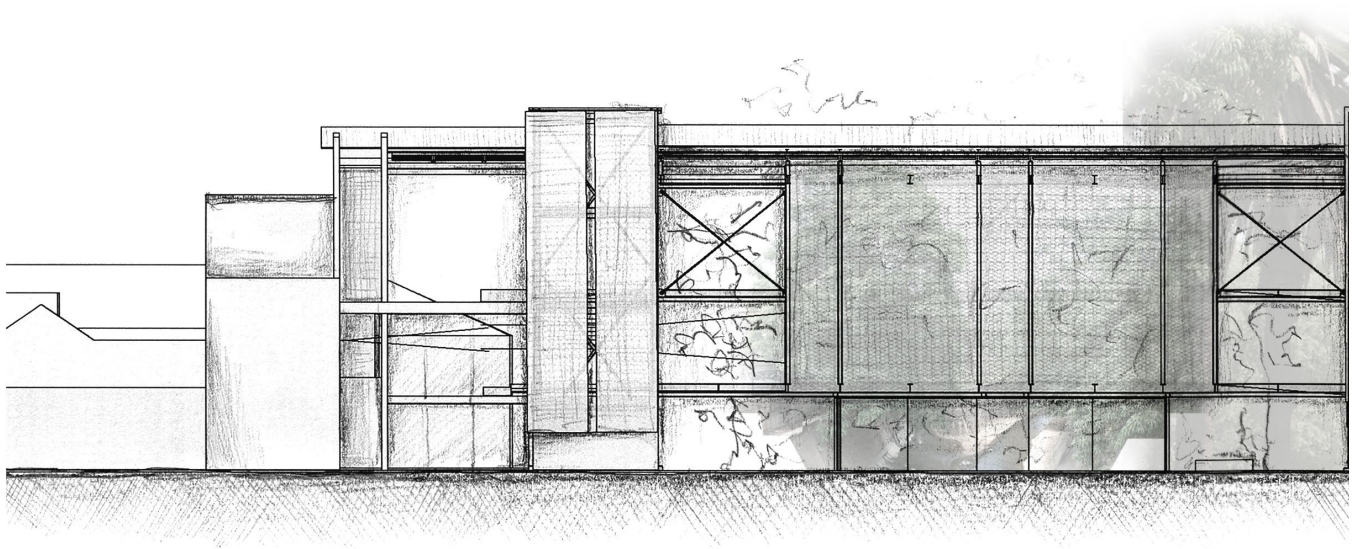


Figure 7.55: Section B-B
NTS
(Author 2015)





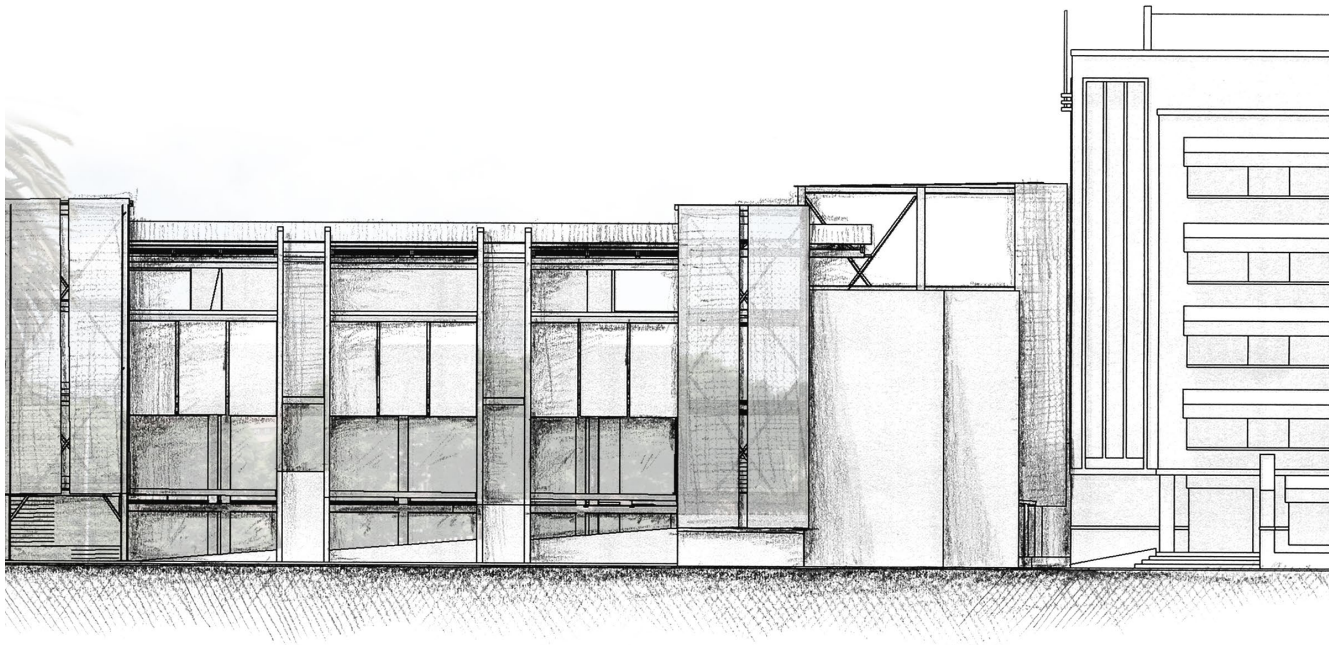


Figure 7.56: North Elevation
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(Author 2015)

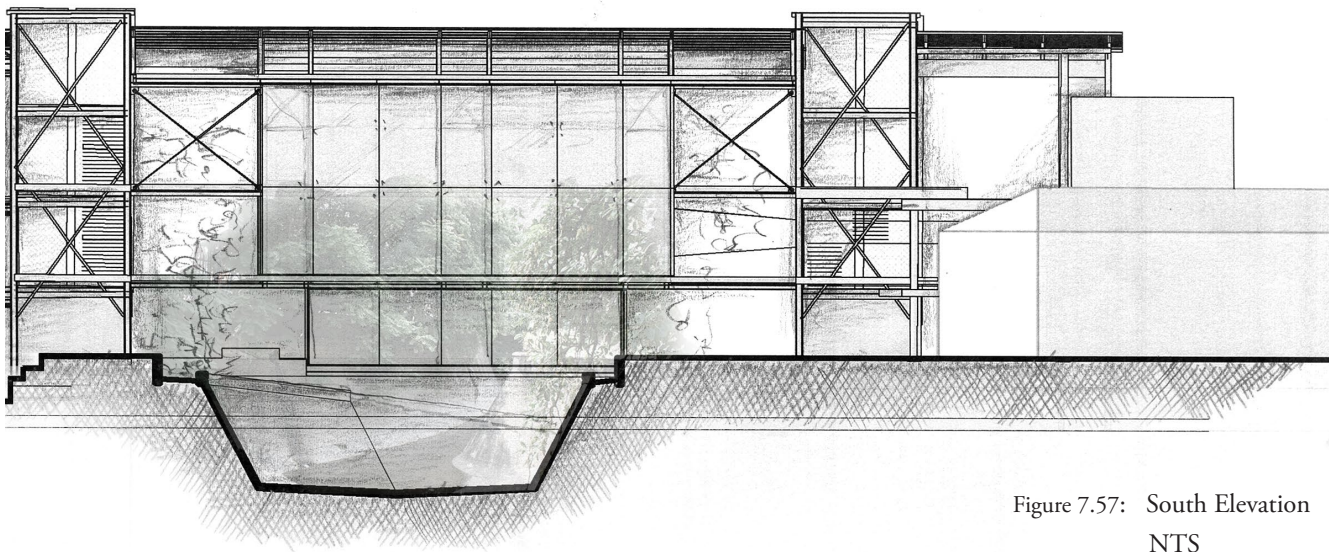


Figure 7.57: South Elevation
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08

CHAPTER EIGHT

TECHNICAL DEVELOPMENT

Introduction: Technical and Structural Intentions

Material Palette and Application

Sculpting the Landscape through the Constructed Water Channel

The Structural and Service Spine

The Internal and External Edge Conditions

Water as Service and Environmental System

8.1

Introduction: Technical and Structural Intentions

The technical development becomes an extension of the design process discussed in Chapter 8: Design Development, and aims to technically illustrate and synthesise the refinement process and most significant technical requirements towards a final resolution of the main conceptual intentions.

The technical development discussion is structured as an elaboration on the various components of the primary intentions toward a technological resolution of materials and methods as concluded in the final design diagrams. The chapter concludes with an investigation of the conceptual intentions through the environmental systems and services (see material palette and descriptions of material choices).

Sculpting the landscape through the constructed water channel:

The continuous sculpted landscape, water channel and boundary wall are constructed as a continuous stereotomic concrete platform, creating a continuous translation between the ground and lower boundary wall condition.

The Service and structural core:

The extended structural and service spine as filtration device, supporting the continuous lightweight roof structure, mediates between the stereotomic concrete landscape and the extended steel structure, and is expressed through the change in material application method and resolution of connections. The infrastructural nature and structural integrity of the continuous service spine is expressed through the robust nature and bracing of the structural components.

The internal and external edge conditions as serviced by the structural and service core:

The circulation and public street activities skin / façade is constructed as a tectonic steel frame to express the permeability and rigid organisation of the structure, responding to the public contextual and functional informants.

The internal activities are supported by circular steel members to express the lightness, transparency and permeability of the structure and translate its relationship to the constructed natural landscape through structures and spaces that are adaptable, organic and less restricted by contextual and functional conditions.

Water as Service and Environmental System:

The concept of water as providing opportunities for activities and spatial and structural arrangements is continued through an expression of water as service and environmental system.

Continuous Roof Structure:

- Galvanised Concealed fix roof sheeting
- Cold formed steel lipped channels
- Polyisocyanurate insulation
- Galvanised and Intumescent painted steel I-beams
- Cast-in-situ reinforced concrete gutter

Internal and External Facade:

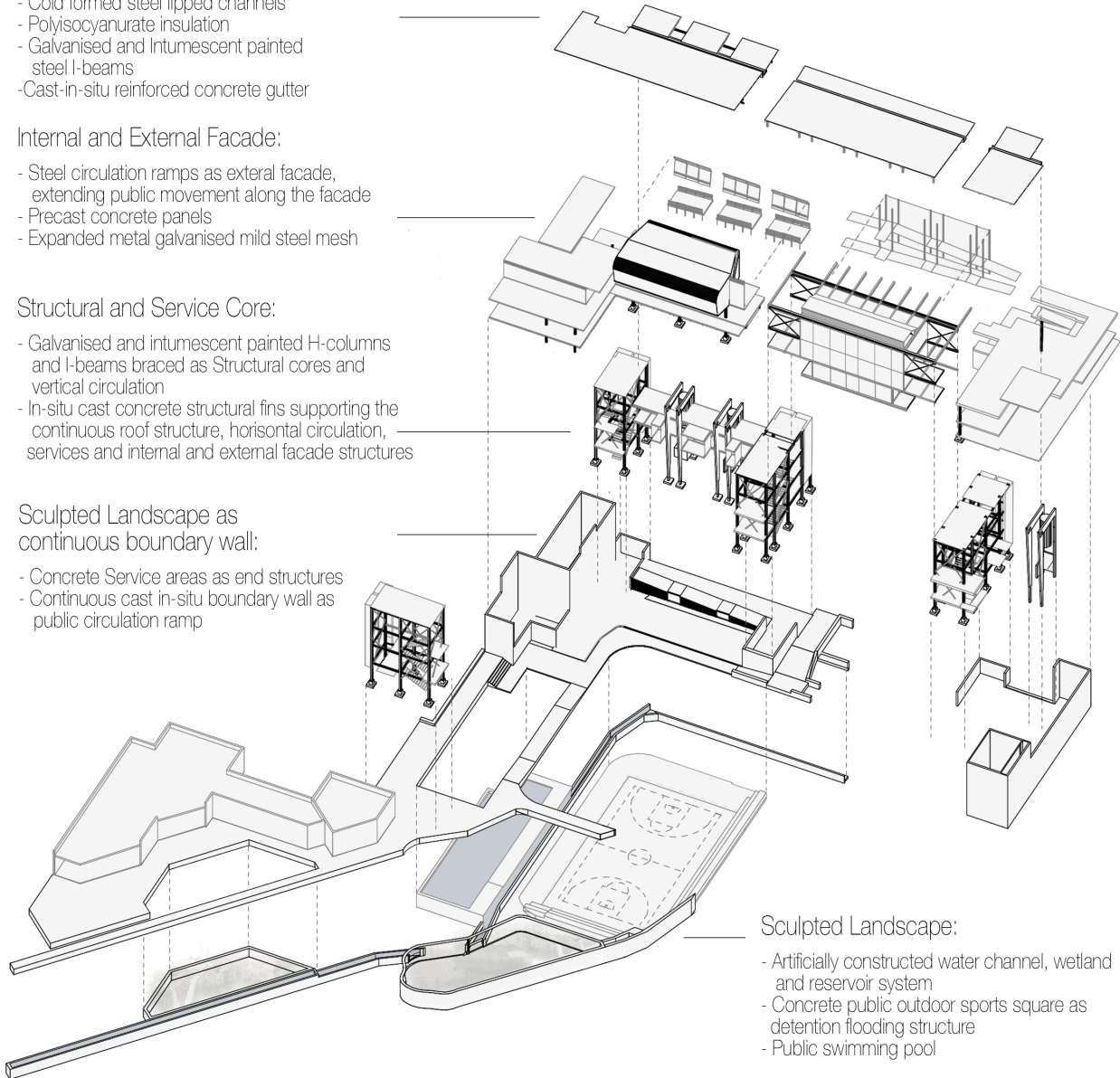
- Steel circulation ramps as external facade, extending public movement along the facade
- Precast concrete panels
- Expanded metal galvanised mild steel mesh

Structural and Service Core:

- Galvanised and intumescent painted H-columns and I-beams braced as Structural cores and vertical circulation
- In-situ cast concrete structural fins supporting the continuous roof structure, horizontal circulation, services and internal and external facade structures

Sculpted Landscape as continuous boundary wall:

- Concrete Service areas as end structures
- Continuous cast in-situ boundary wall as public circulation ramp



Sculpted Landscape:

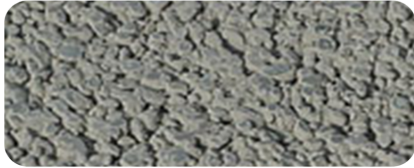
- Artificially constructed water channel, wetland and reservoir system
- Concrete public outdoor sports square as detention flooding structure
- Public swimming pool

Figure 8.1: Exploded axonometric of the main components of the structure and site (Author 2015)

Material Palette and Application

Sculpted Landscape

Pervious (No fines) Concrete



Steel trowelled finish to cast-in-situ reinforced concrete slabs



Due to the extent of the reconstruction of the landscape as well as the significance of harvesting stormwater run-off on site, the existing asphalt parking terrain is replaced with concrete predominantly as conceptual and aesthetic continuous sculpted material that becomes the base platform to the steel structures. (The existing asphalt to be used for filling and excess to be recycled.)

Pervious concrete is selectively used to increase the sustainability of the site through allowing stormwater to replenish the groundwater table. Pervious concrete to be created with narrow graded coarse aggregate, mixed with cement paste or mortar. Fines as used in conventional concrete to be eliminated.

The internal concrete floor areas are constructed of a cast in-situ reinforced concrete floor slabs with a monolithic topping. The topping to be mechanically floated and trowelled, using the delayed trowelling method to obtain a hard, smooth finish.

Permissible deviation to be Class 2: 10mm from datum level. Concrete to have a characteristic 28-day compressive strength of Class AR2. The coarse aggregate to be used for monolithic toppings should be of 6,7mm nominal size. The expansion joints as well as joints around the columns to correspond with the structural grid and be at maximum 3000mm x 4000mm spacing.

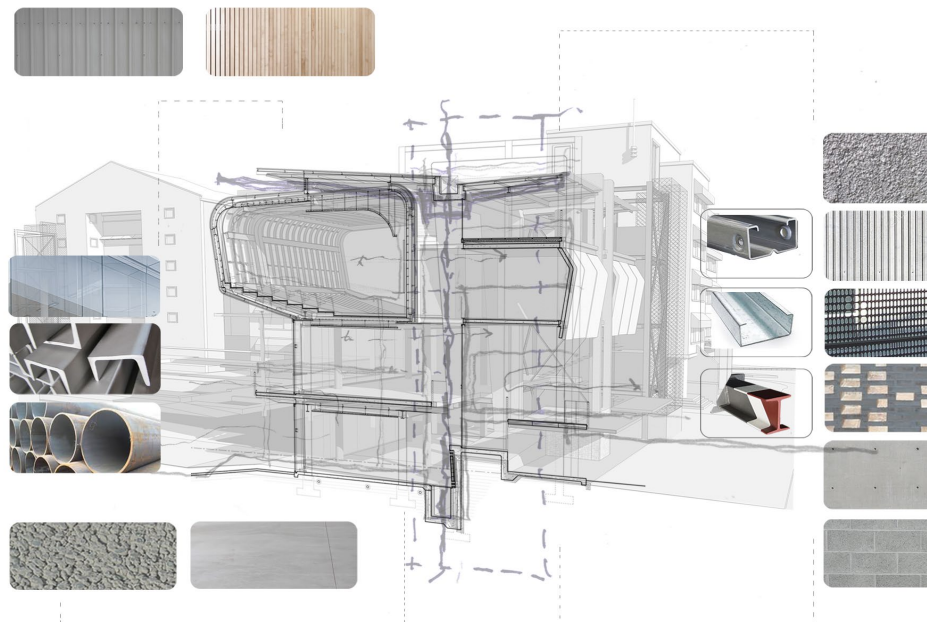


Figure 8.2: Conceptual illustration of materials used and construction methods as elaborated in the material palette (Author 2015)

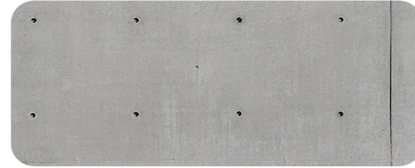
Boundary wall and Structural fins

Precast Concrete bricks



The boundary retaining wall acts as ventilating structure to the interior space and water channel and its internal skin is constructed of 140mm x 90mm precast concrete bricks, with the lowest two coarses laid on edge to provide an aesthetic edge to the wall as well as ventilation openings. The use of precast bricks allows for an ease of constructing the internal skin after the curing of the concrete sculpted floor, channel and ramp.

Off-shutter in-situ concrete walls and precast panels



The structural fins that are expressed on facade as the structural and service core, containing environmental systems as well as providing the central structural support, becomes important elements to express its truest form of material finish without treatment or cladding. A smooth off-shutter concrete finish is specified and achieved through the use of steel formwork with a phenolic film on the surface. For areas with compaction difficulty due to restricted space, self-compacting concrete (SCC) should be considered.

Internal and External thresholds

Structural glazing



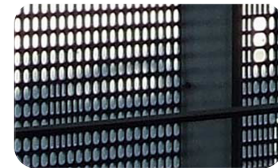
Structural glazing is used as internal and selectively external threshold, creating a transparent transition between internal and external environments throughout the building as well as allowing significant sight-lines around the sight to remain exposed. A monolithic, anti-reflective, thermally tempered safety glass is to be used in a double glazed system that allows for the seamless aesthetic of silicone butt joint connections without frames as well as enhanced thermal resistance and a 2hour fire protection rating. Glass thickness availability up to 12mm and to be specified according to the structural requirements of the thresholds.

Precast concrete brick skin as



A precast concrete brick skin, with selected bricks laid on edge, is used as threshold to internal service space window openings to allow for the filtration of natural light as well as ventilation by still maintaining the privacy of the internal activities.

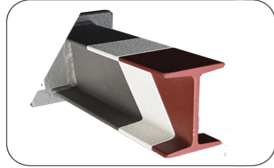
Galvanised mild steel expanded mesh screen



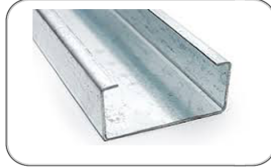
The external circulation and structural towers as well as the screen enclosing the circulation ramps across the Apies River channel are clad with a galvanised mild steel expanded mesh, fixed to a secondary supporting steel structure. The use of expanded mesh allows for a continuous surface throughout, without joints, interweaving or welds and has a high

Primary and Secondary supporting structure

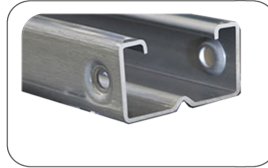
Hot-rolled galvanised steel sections



Cold-formed galvanised steel sections



Galvanised light-gauge steel frame sections



The primary steel components of the structural core are conceptually and aesthetically expressed through the use of exposed hot-rolled Galvanised and Intumescent painted H-columns and I-beams. The main infrastructural towers (columns) as external spaces, supporting the extent of the spanning structure expresses this structural integrity through the exposure of its primary members and its galvanised steel angle bracing components that allow the towers to act as a collective column structure. The exposure of the bolted connections between the steel members contributes to the infrastructural aesthetic of the structural core.

The secondary structural components supporting the continuous roof structure as well as the exterior and interior finishes are constructed of cold-formed galvanised steel sections as lightweight supporting structure, spaced according to the requirements of the finish specification. All steel connections to be bolted as opposed to welding to allow for the disassembly and reuse of components.

The secondary supporting structure of the auditorium space is constructed of galvanised light-gauge steel framing to support the internal and external cladding spacing requirements.

Auditorium Primary Structure

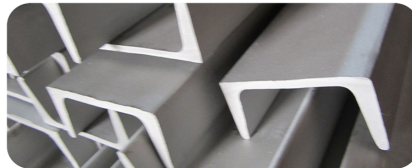
Seamlessly joined, galvanised and intumescent painted circular steel columns



The auditorium space as placed within the landscape, separated from the structural core is vertically supported by six 406mm \O x 8mm seamlessly joined, galvanised and intumescent painted circular steel columns.

The extent of the floor and roof structures adjacent to the structural core is supported by smaller 300mm \O x 6mm seamlessly joined, galvanised and intumescent painted circular steel columns. The use of circular creates a clear aesthetic and structural distinction between the primary infrastructural core and the extended adjacent floor spaces as well as allows for an elegant, transparent reading of the structure due the rounded edges softening and reducing the visibility of the profile size.

Continuous, custom profile galvanised and intumescent painted steel channels



The primary auditorium structure consists of three continuous, custom galvanised steel channels, welded from mild steel plate. The central continuous circular beam is constructed from two channels placed back to back to allow for a central structural member, the acoustic separation of the structure as well as internal support to the secondary structure. The secondary structure to be bolted to the primary channels and all steel sections to be intumescent painted.

Internal and External cladding of the Auditorium Space

Saligna wall planks and acoustic ceiling panels



Saligna wall planks and suspended acoustic ceiling panels are used throughout the building in selected spaces according to absorption and refraction acoustic requirements as well as the spatial and aesthetic contribution of the organic characteristic contrasting and softening the robust and sterile characteristic contributed by the steel and concrete finishes. This aesthetic contrast expresses the integration of a “natural” aesthetic within the building and artificially constructed landscape. The wall planks are fixed to a light-gauge steel framework with acoustic separating spacers and underlay membrane.

Concealed fix galvanised metal roof sheeting



The external cladding of the auditorium structure consists of a continuous concealed fix metal roof sheet, cranced and bullnose according to the structural and spatial requirements of the auditorium. The external cladding is supported by the light-gauge steel framework as secondary structure. Adaptability is made possible through the ability to dismantle and re-use the sheets as there are no fixing holes created in the construction process.

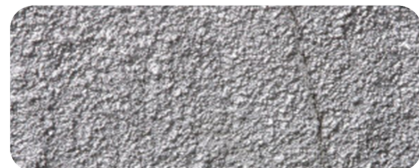
Continuous Roof Structure

Concealed fix galvanised metal roof sheeting



The conceptual intention of the continuous roof structure as an elegant, lightweight slender profile is aesthetically expressed as floating entity elevated above the rest of the structure, is achieved through the use of 0.58mm galvanised concealed fix metal roof sheeting. Apart from the aesthetic considerations, the concealed fixing method offers various pragmatic advantages over the S-Rib or IBR profile sheeting, such as longer spans between purlins due to the structural integrity of the profile as well as the prevention of water penetration through seamless connections.

Cast in-situ off shutter concrete



The extension of the structural and service core at roof level is expressed through the central cast in-situ concrete gutter collecting and conveying rainwater along the roof level to storage areas. The use of concrete as structural beam allows for the reduction in depth of the steel roof's supporting beams' profiles. The internal surface area of the gutter to be lined with a waterproofing membrane and all connections between the sheet metal and concrete to have sheet metal flashings and counterflashings.

8.3

Sculpting the Landscape through the Constructed Water Channel

The constructed water channel, as discussed in Chapter 8: Design Development, is constructed as a primary unifying concrete component of the design, embedded in the artificial landscape. The water channel facilitates a process of harvesting stormwater runoff and treated greywater from service areas into a linear system for treatment and reuse in various activities of the site. The processes and components of the ground-floor water system are discussed under the environmental system and services section of the technical development chapter. The activities around the site, activated or influenced by the continuous water channel, are discussed in their respective parts below. (See Figure 8.3)

8.3.1

Horticulture workshop and greenhouses

The horticulture workshop and greenhouse structure become the furthest activation point of the channel that extends through the greenhouse structures as edge to the main circulation route through the site, leading to the central constructed wetland area. The edges of the exposed channel between the greenhouse structures are raised as a boundary wall to the constructed wetland areas, and vegetated as bioswales for the untreated stormwater runoff as well as an aesthetic edge to the circulation route. (See Figure 8.3)

8.3.2

Public swimming pool and outdoor sports court

The circulation route continuing between the outdoor sports court and the public swimming pool is created by the continuation of the water channel from the building to the central constructed wetland (See Figure 8.3) The edges of the water channel are extended to become a supporting boundary structure between the seating area of the outdoor court and the raised swimming pool seating platform, and are partially exposed through the platform as points of reference on the circulation route, with exposure to the water processes of the site (See Figure 8.3).

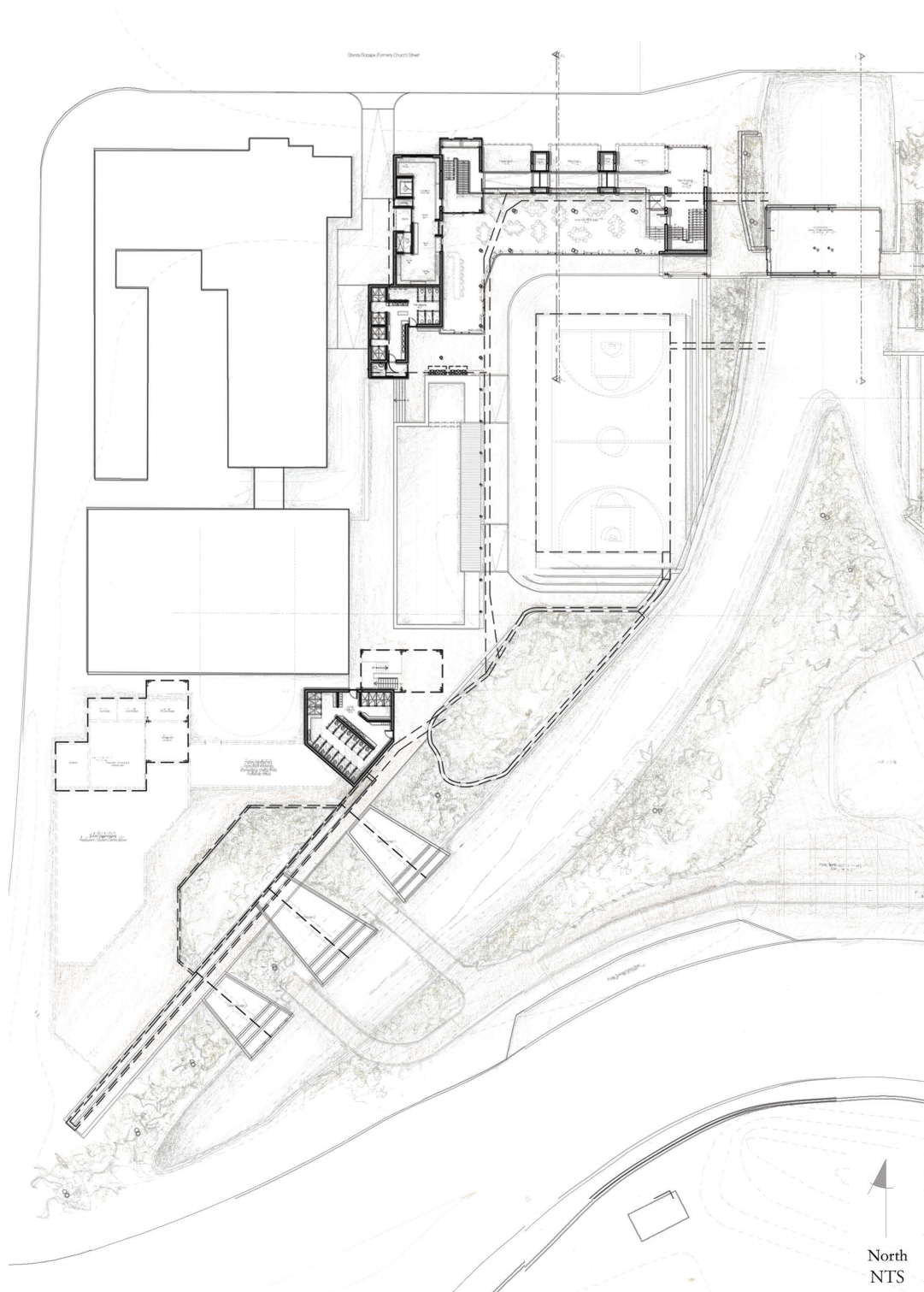


Figure 8.3: The circulation route and activities around the site, activated or influenced by the continuous water channel (Author 2015)

9.3.3

Water channel as structural and service spine to building

The water channel extends from the sculpted landscape and circulation route into the recreational social club and event space, becoming the structural and service spine at ground floor level that continues through the building with an overflow into the Apies River at the entrance lobby suspended above the Apies River channel (See Figure 8.1).

The concrete surface bed of the recreational social club is continuously moulded from the external landscape into the internal edge of the concrete channel, extending into the channel and external boundary edge to the recessed internal ground-floor space. The external edge of the channel as boundary wall becomes the concrete circulation ramp at street level, supporting the extended concrete structural fins that contain all environmental systems and services. The sculpted ground is finally extended into a continuation of the external raised surface bed to the market spaces at street level (See Figure 8.4 and Figure 8.5).

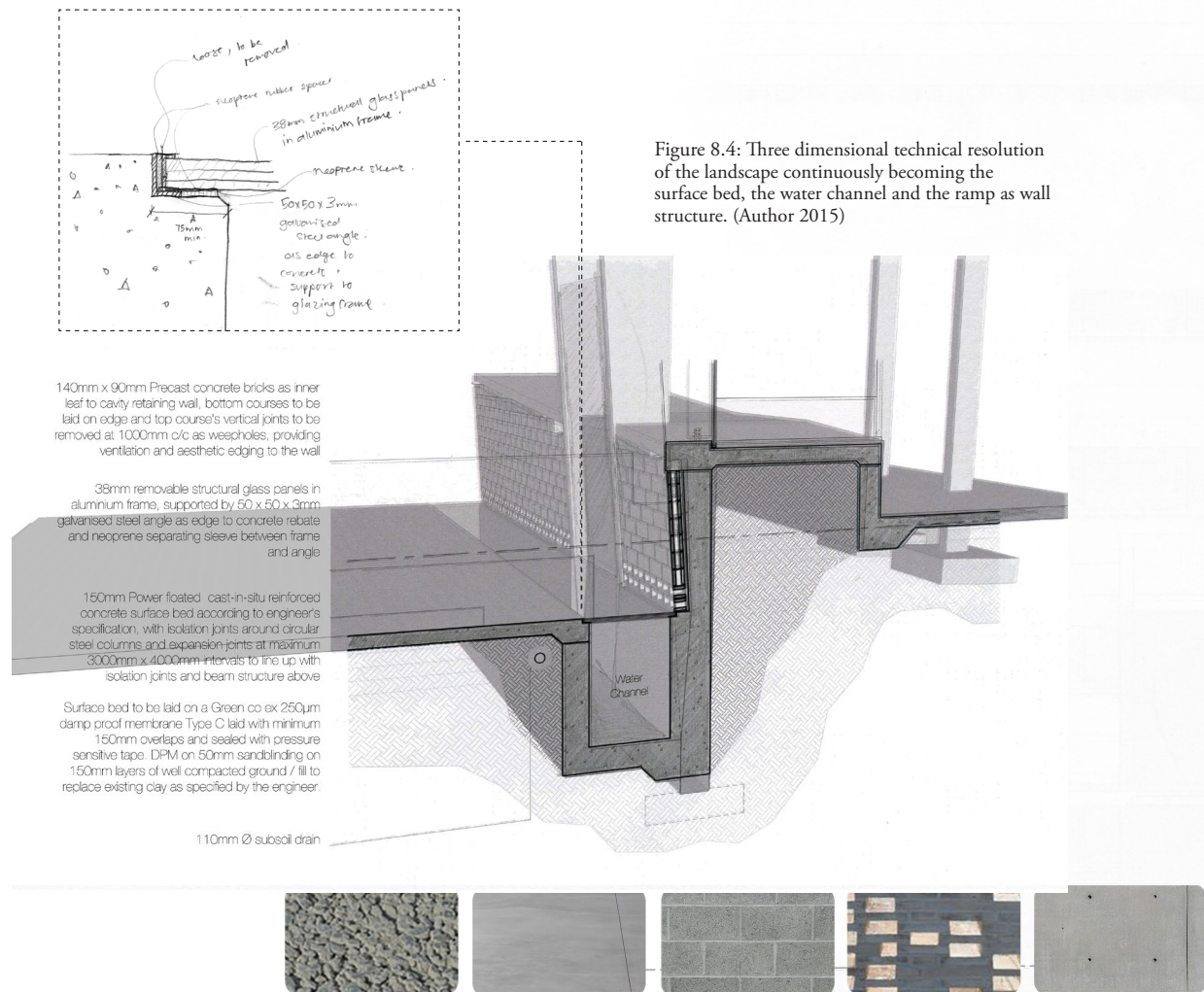


Figure 8.4: Three dimensional technical resolution of the landscape continuously becoming the surface bed, the water channel and the ramp as wall structure. (Author 2015)

Figure 8.4 [Section A-A (1)] and Figure 8.5 [Section A-A (2)] illustrates an iterative development of the ground floor condition and technical resolution, through the continuous landscape from the internal public square to the external street activities, becoming the boundary structure to the site and support the the structural and service core.

The construction of the water channel and boundary retaining wall is approached as a ventilating structure, as opposed to a tanked construction, allowing water to drain through the wall cavity into the continuous channel that obviates the necessity for a sump.

In the case of extreme flooding occurring at the confluence of the Apies River and Walker Spruit, the channel would act as additional drainage outlet to the internal ground-floor spaces, and this fact has an influence on the finishing of the surface bed.

Figure 8.6 illustrates a three-dimensional technical resolution of the constructed water channel within the ground floor space. The boundary, ventilating cavity wall consist of an external continuous concrete structure with an internal skin constructed from 140mm x 90mm precast concrete bricks with the bottom two courses laid on edge and the top vertical joints as weepholes at every 1000mm c/c, to provide ventilation openings as well as an aesthetic texture surface to the boundary ramp.

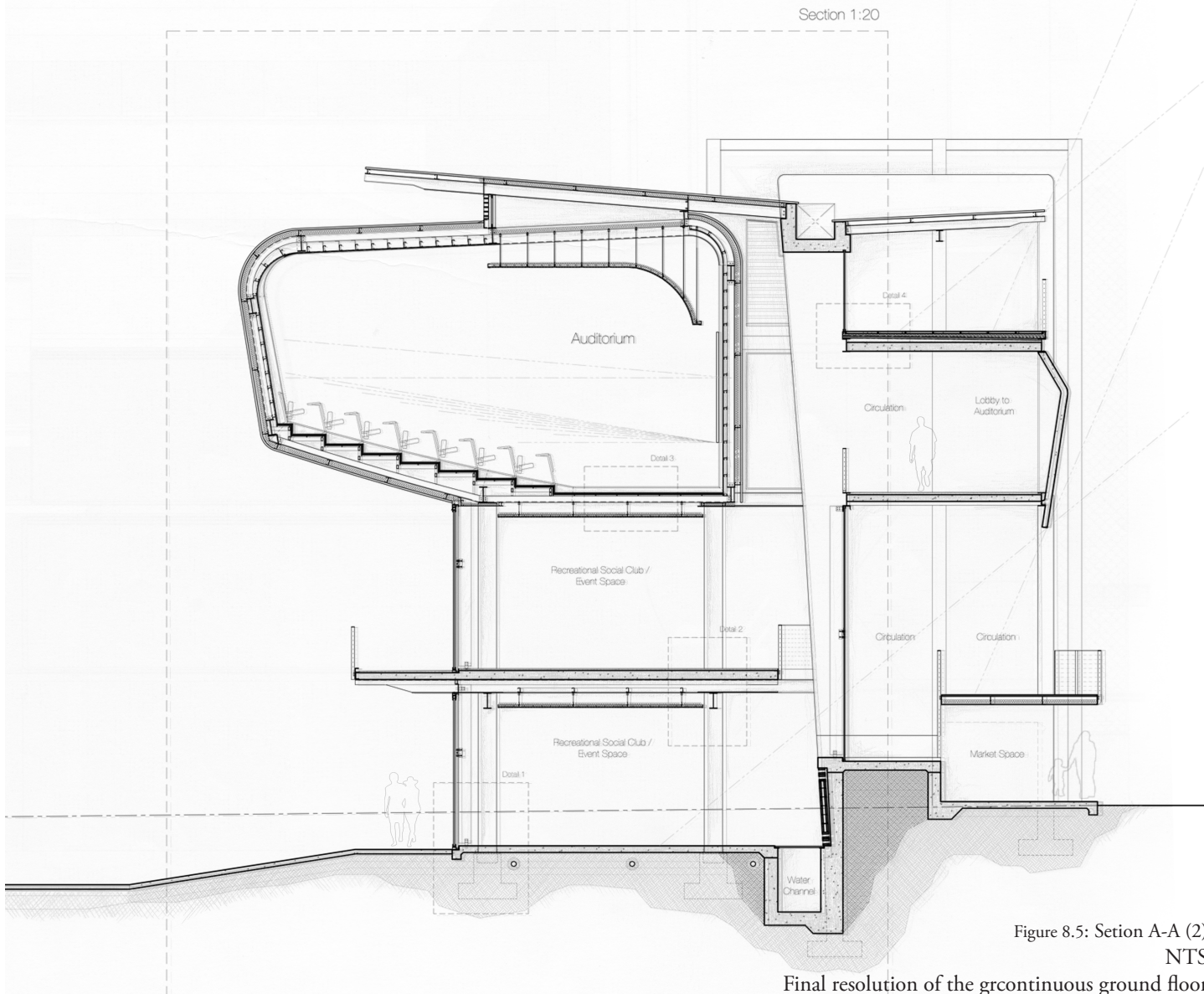


Figure 8.5: Section A-A (2)
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Final resolution of the continuous ground floor
(Author 2015)

8.4

The Structural and Service Spine

The service and structural core as an extension of the sculpted landscape consists of:

1. The boundary wall structure
2. The three primary structural cores
3. Environmental systems and services contained within the spine
4. The continuous roof structure

and is discussed according to its various components as illustrated in the conceptual diagrams (See Figure 8.7, Figure 8.8 and Figure 8.9).

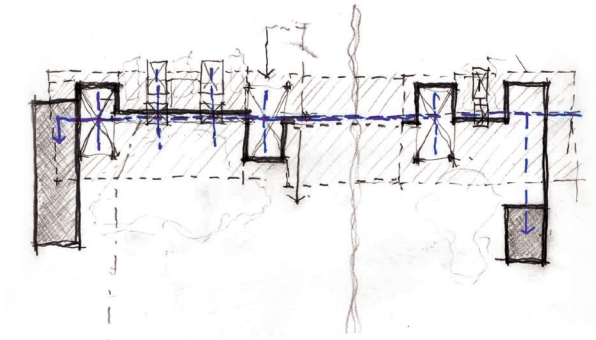


Figure 8.6: Plan diagramme illustrating the conceptual intentions of the structural and service core. (Author 2015)

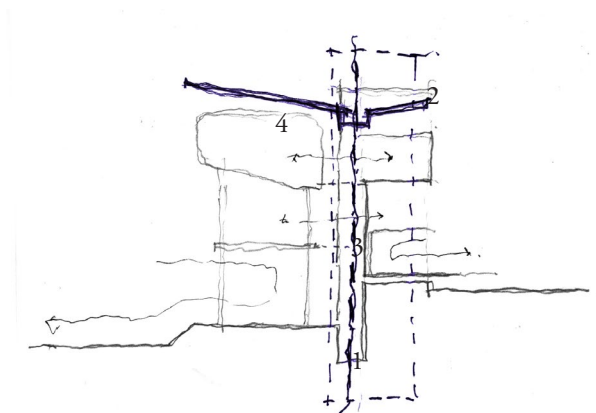


Figure 8.7: Section diagramme illustrating the conceptual intentions of the structural and service core. (Author 2015)

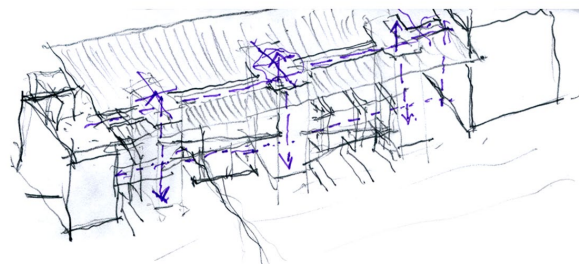


Figure 8.8: Perspective diagramme illustrating the conceptual intentions of the structural and service core. (Author 2015)

8.4.1

The boundary wall structure

The boundary wall structure adapts and transforms to facilitate the various functional conditions throughout the building, but reads as a unifying entity of the structural core on ground level through its continuity and materiality. The depth of the central section of the boundary wall containing the market spaces creates the circulation ramp into the first-floor spaces, and the extent of the wall terminates in the eastern and western full-height service structures as stereotomic edges to the building (See Figure 8.11).

The western and eastern service end structures contain the public ablution and kitchen facilities on all floor levels as decentralised service cores to the site. The structure of the service areas consists of 280 mm thick, 250Mpa cast in-situ off-shutter concrete walls with plywood shuttering to create a smooth external finish. Joints are to be lined up with the top edges of window openings on each floor.

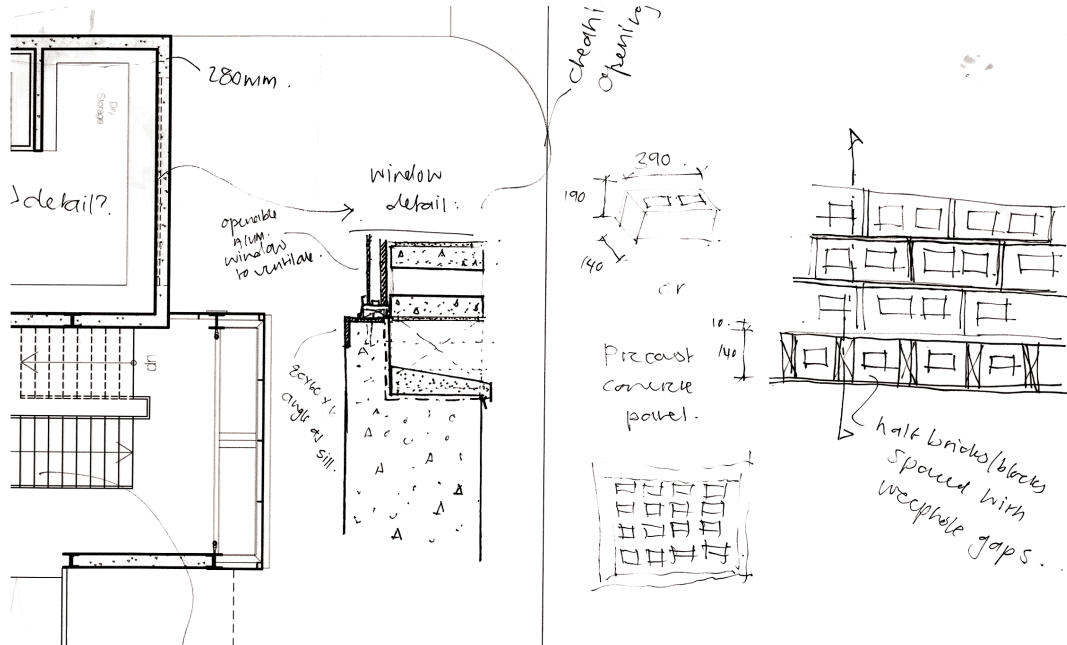
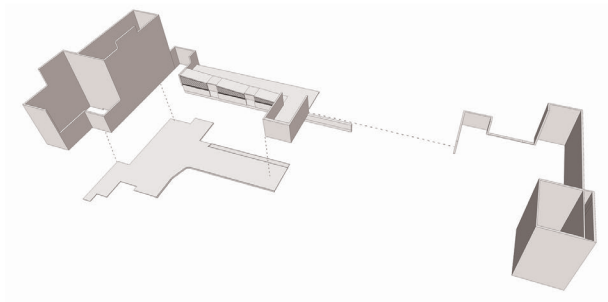


Figure 8.9: Detail development of the window details (Author 2015)



In these service areas, the window openings with their bottom sills at a height of 1500 mm are constructed with an external concrete brick on edge skin within the concrete walls, with sliding glass panels behind, providing filtered light without reducing the privacy of these areas on the street façade (See Figure 8.10).

Figure 8.10: Axonometric of the continuous concrete boundary wall and service structures . (Author 2015)

8.4.2

The three primary structural towers as infrastructural cores

The three primary structural cores facilitate an aesthetic and structural mediation between the stereotomic substructure and the ground floor condition, and extend from the concrete boundary wall as tectonic steel-framed structures. The collective structure of the cores consists of 305 mm x 305 mm x 97 mm hot-rolled, galvanised steel H-columns and 254 mm x 146 mm x 31 mm hot rolled, galvanised steel I-beams, and are braced at the indicated edges with compression rods, (See Figure 8.12 – development of the towers), to provide lateral support and ensure the structure acts as a single column.

The concrete wall sections as well as the floor landings between the columns supplement the lateral bracing of the collective columns. The structural integrity and infrastructural nature of these towers as core supporting entities are expressed through their materiality contrasting with the lightweight extended structures adjacent to the towers as well as the exposure of its structural components and connections.

The bracing of the columns as collective structural entity, specifically the two structures adjacent to the Apies River channel, supports the 29 m span of the exhibition spaces suspended across the channel. The second-floor wall structures are braced as lightweight structural beams, supporting the suspended first-floor and ground-floor platforms. Figure 8.12, Figure 9.16, Figure 8.16, Figure 8.17 and Figure 8.18 illustrate the technical development of the spanning structure to express the conceptual intentions of lightness and materiality, and its relationship to the historic Lion Bridge.

Beyond a structural purpose, the towers provide central vertical circulation and fire-escape cores along the building, and contain additional tanks for storage of harvested rainwater as well as water pumped from the reservoirs to supply water closets in the adjacent service areas.

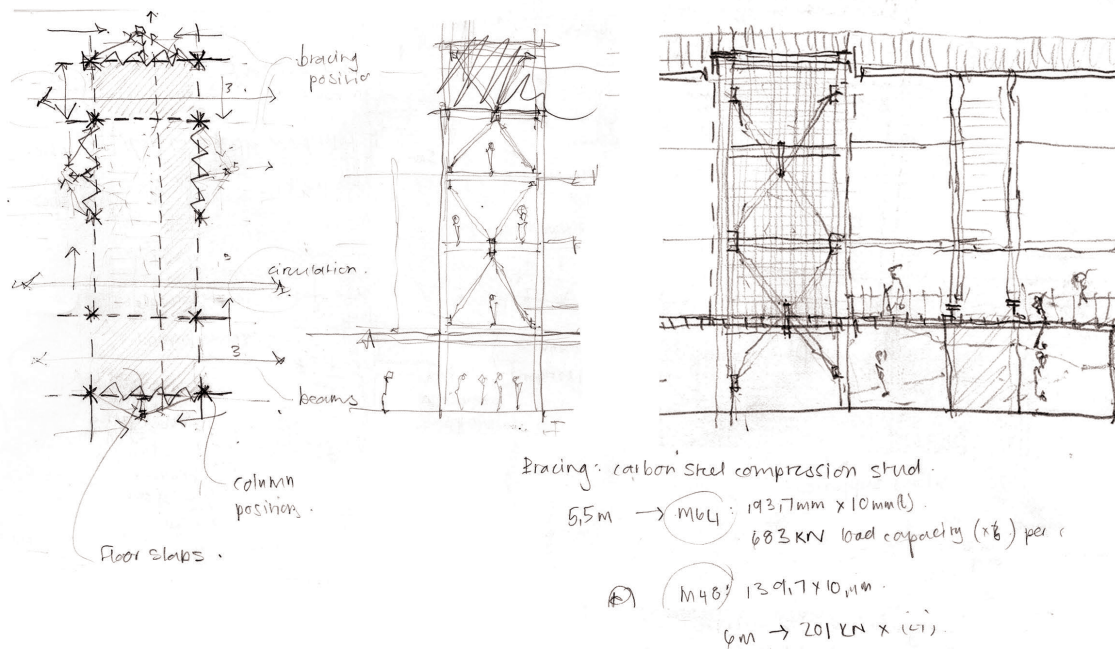


Figure 8.11: Development and perspective illustration of the structural towers and bracing connections as well as development of the spanning structure across the Apies River channel. (Author 2015)

8.4.3

Environmental systems and services contained within the structural core

The structural concrete fins are built of 280 mm thick, 250Mpa cast in situ off-shutter concrete with plywood shuttering to create a smooth external finish. They support the first-floor lightweight steel circulation area, the second-floor waiting area floor and roof structure, and the northern glazed and precast concrete panel façade that spans between the steel towers and concrete fins.

Storage tanks for rainwater harvested from the continuous roof are supported between the exterior sections of the

concrete fins to supply the indirect evaporative cooling towers contained within the interior sections of the concrete fins. The system, structure, finishes and technical requirements of the cooling towers are discussed in the environmental systems and services section of this chapter.

Alternating between the enclosed indirect evaporative cooling towers, the concrete fins frame continuous vertical ventilation spaces throughout the section of the building, and have ventilation openings at the top.

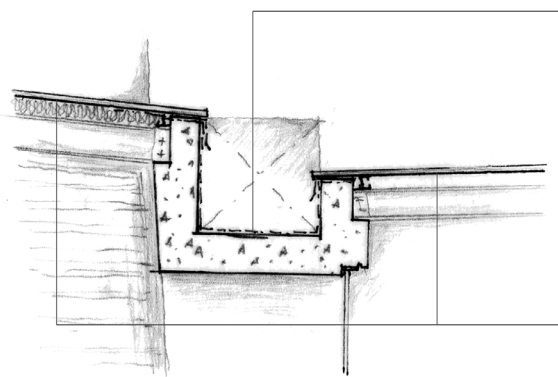
8.4.4

The continuous roof structure

The continuous roof structure becomes the unifying element of the structural and service spine. Supported between the structural core towers and concrete fins, the continuous roof structure consists of 0.58 mm thick galvanised roof sheets, fixed to 100 mm x 50 mm x 2.5 mm galvanised cold-formed steel-lipped channels at a maximum spacing of 1500mm c/c by means of a concealed fastening bracket, directly over 100 mm thick polyisocyanurate insulation installed between purlins according to supplier specifications. A 254 mm x 146 mm x 31 mm galvanised steel I-beam, painted with intumescent paint, and at a maximum spacing of 4000mm c/c according to the structural grid, supports the roof structure and is fixed to the concrete gutter as structural beam.

The roof section extending across the spanning exhibition structure is changed from a concrete gutter beam to a concealed lightweight steel gutter, as informed by the structural and aesthetic requirements of the exhibition spaces. Its internal form and surface is influenced by southern daylight considerations.

Figure 8.14 and Figure 8.19 illustrates of the roof structure in consideration of the significant influential factors identified as water harvesting, protection of solar angles, and internal spatial and service area implications. The aesthetic lightness and slender profiles of the roof's supporting structure is achieved through the utilisation of the continuous gutter as supporting concrete beam



850mm x 400mm x 300mm deep cast-in-situ reinforced concrete gutter to engineer's specification, with a waterproofing lining and roof flashing and counter flashing at edges, suspended between concrete structural fins.

0.58mm thick Galvanised Concealed fix roof sheet profile, to be fixed to 100mm x 50mm x 2.5mm Galvanised cold formed steel lipped channels at maximum 1500mm c/c spacing by means of a concealed fastening bracket, directly over 100mm thick Polyisocyanurate insulation installed between purlins according to supplier specifications.

Brackets shall be manufactured from Galvanised steel and shall be fixed to steel purlins with one 25-50 mm long full thread self-drilling screw

Figure 8.12: Detail of the concrete gutter and roof sheeting connections. (Author 2015)

8.5

The Internal and External Edge Conditions

8.5.1

External activities as facade

The external spatial conditions and threshold to the public street activities are contextually informed, and the assembly of its structure aims to express that significance. Rigidly organised and contained by the components of the structural and service spine, the external façade activities create an aesthetic rhythm across the façade of the building.

The western edge of the site is activated on ground-floor level by the adaptable market spaces that are enclosed at ceiling level by the lightweight steel ramp leading to the first-floor spaces (See Figure 8.14).

The second-floor façade is enclosed by precast concrete panels with recessed, vertical, fixed glazed openings between the panels, allowing northern light to penetrate the internal spaces without permitting direct solar gain.

The external skin of the exhibition spaces spanning across the channel becomes a continuance of the circulation ramps that animate the façade. Figure 8.15 to Figure 8.18 illustrates the structural intention to create a transparent spanning structure at ground level through the recessed suspension of the ground-floor platform as well as the perforated stainless-steel screen diffusing the first- and second-floor circulation activities while simultaneously facilitating a filtered northern daylight condition in the exhibition spaces.

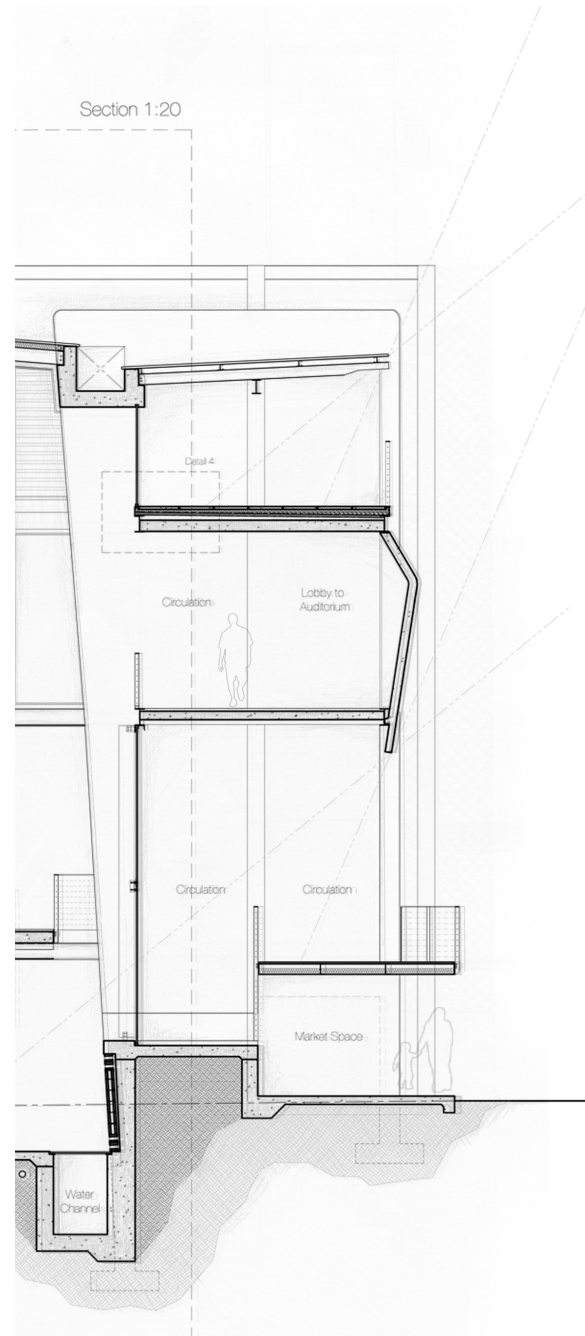


Figure 8.13: Section of the external facade on Stanza Bopape Street illustrating the circulation as facade activity from ground floor extending throughout the building (Author 2015)

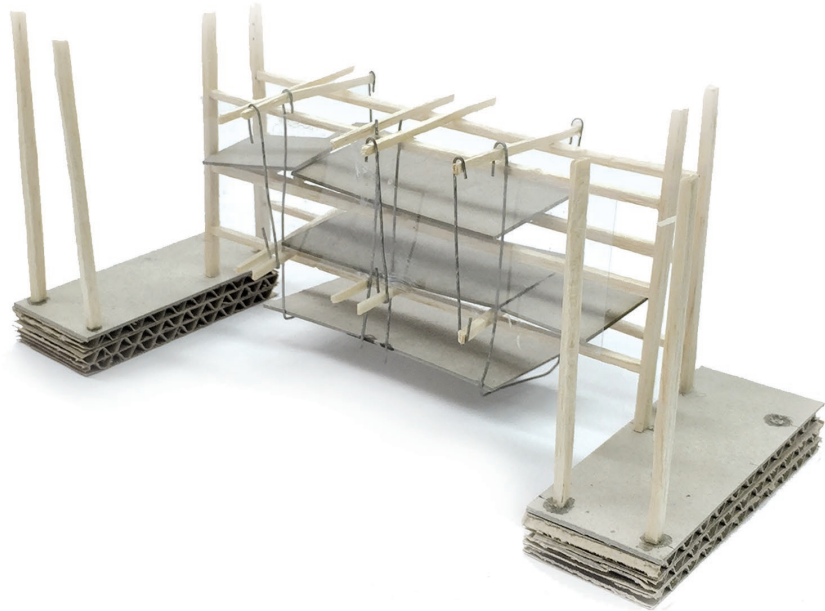


Figure 8.14: Photographs of the structural development of the exhibition structure spanning the Apies River channel through model exploration. ((Author 2015)

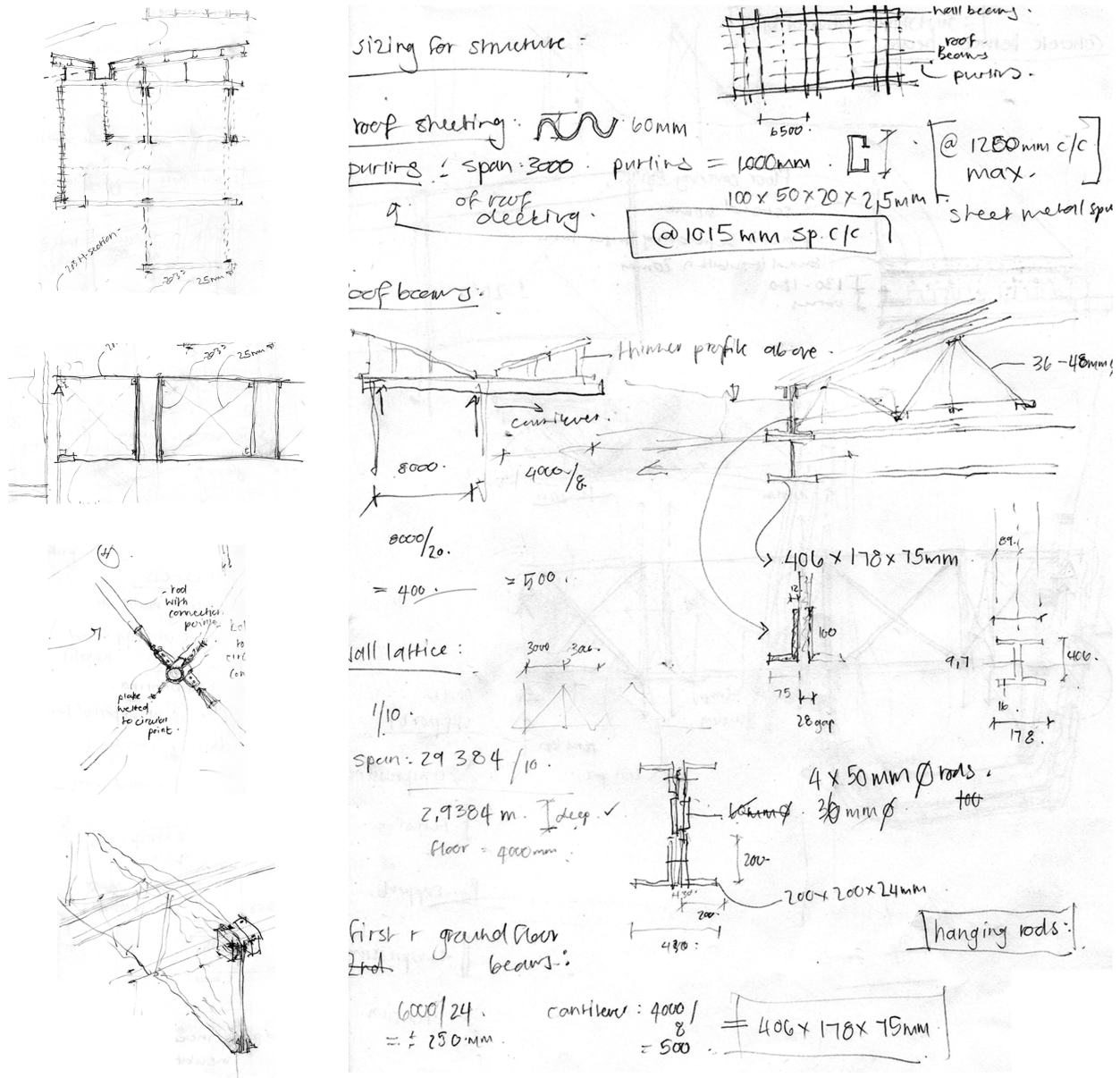


Figure 8.15: Structural investigation towards developing an appropriate resolution for the conceptual, aesthetic, functional and spatial requirements. (Author 2015)

Continuous Roof Structure:

- Galvanised Concealed fix roof sheeting
- Cold formed steel lipped channels
- Seamless Aluminium gutter with neoprene sleeve
- Polyisocyanurate insulation ceiling
- Galvanised and Intumescent painted steel I-beams roof trusses

- Frameless structural double glazing envelope with stainless steel spider clamps, fixed to steel channel as end to floor slab.
- 260mm cast in-situ suspended floor slab between floor I-beams

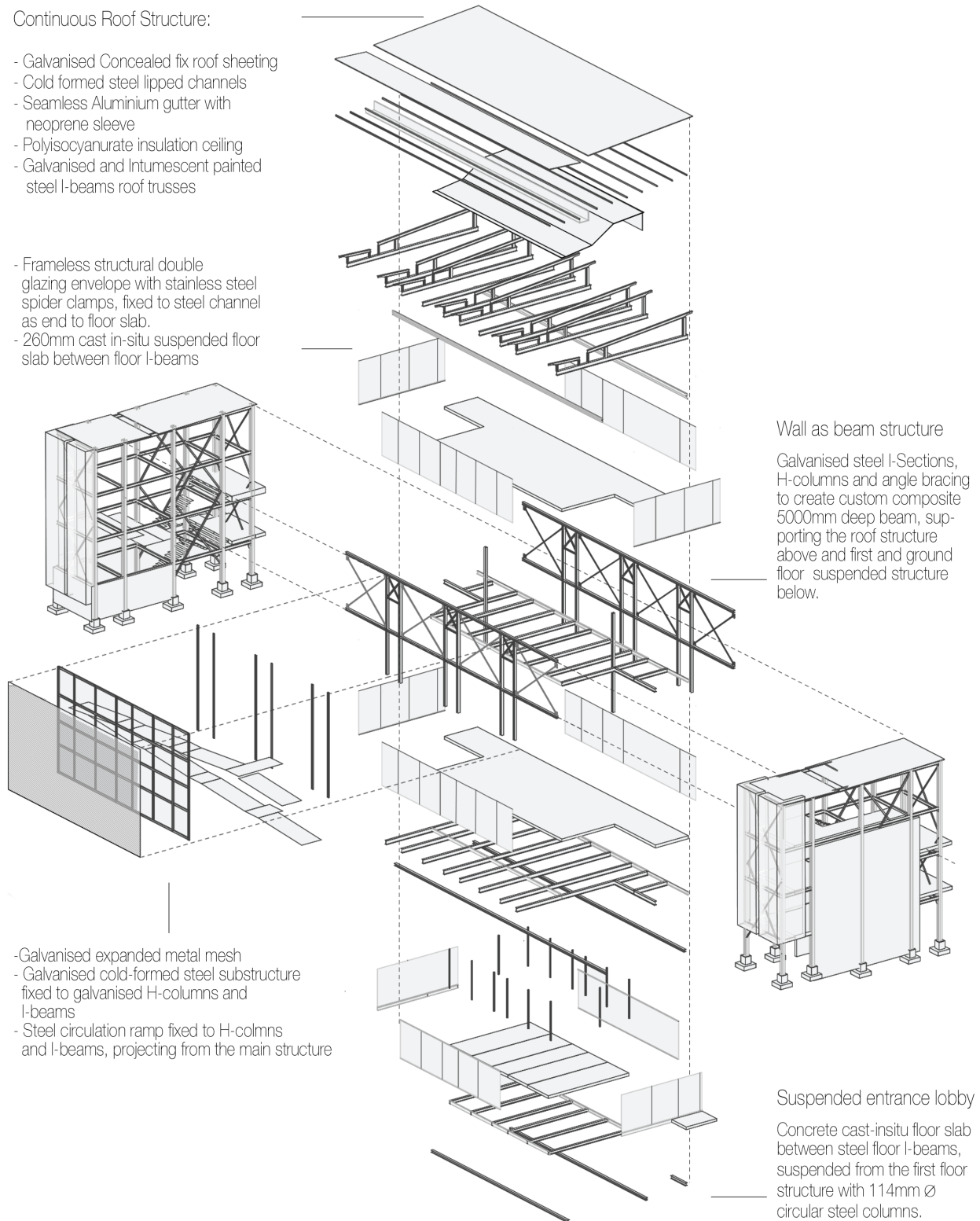


Figure 8.16: Exploded axonometric of the exhibition structure spanning the Apies River channel. (Author 2015)

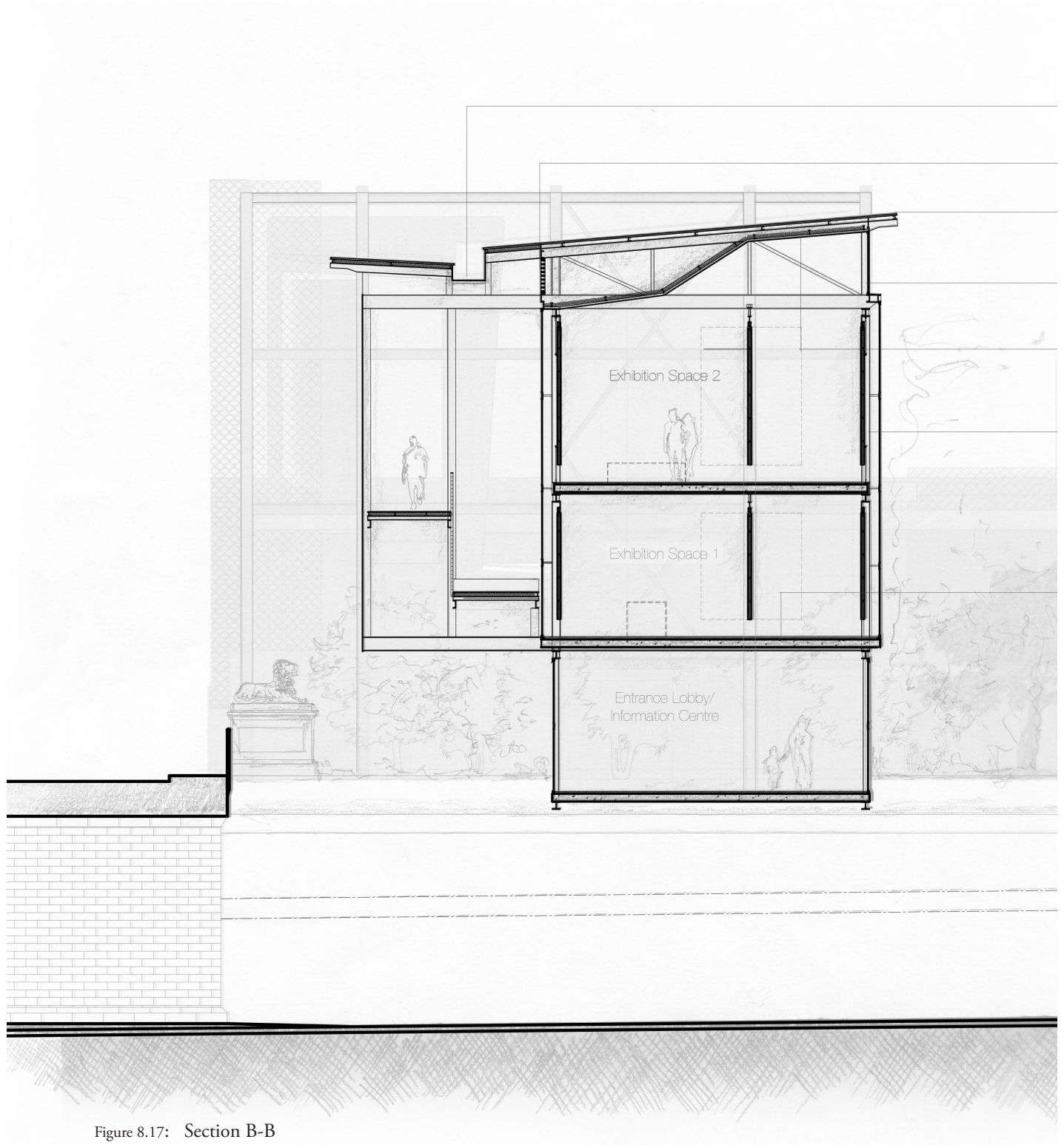


Figure 8.17: Section B-B
NTS
(Author 2015)

850mm x 400mm Purpose made seamless aluminium box gutter, supported by gutter brackets fixed to the galvanised steel trusses with a neoprene separating sleeve. Gutter and roof sheeting to be flashed and cunter flashed

Fixed aluminium louvre

0.58mm thick Galvanised concealed fix roof sheet profile, to be fixed to 100mm x 50mm x 2.5mm galvanised cold formed steel lipped channels at maximum 1500mm c/c spacing on a reflective foil insulation layer

Openable Glass louvre with aluminium frame, fixed to steel trusses with neoprene sleeve

White painted gypsum ceiling board fixed to 100mm x 50mm x 2.5mm galvanised cold formed steel lipped channels, bolted between IPE 100 galvanised hot rolled steel I-sections bolted between the steel roof trusses

4000mm Composite beam structure consisting of 305mm x 102mm x 25 galvanised and intumescent painted H-sections as horizontal beams and vertical columns. 25mm Ø Compression rods to be used as diagonal bracing between frame. The horizontal structural members to be bolted to the end towers by means of a suspended bracket to allow for minimal movement across the extent of the span. The collective structural integrity of the beam supports the suspended first and ground floor structures

30mm power trowelled monolithic concrete topping on a 200mm reinforced cast-in-situ reinforced concrete slab to engineer's specification, supported between 356mm x 171mm x 45 galvanised and intumescent painted steel I-beams



8.5.2

Internal activities placed within the landscape

The internal activities placed within the landscape are explored through an iteration of refining the conceptual intentions through the development of the structure. At first-floor level, the reinforced, cast in situ floor slab is supported on galvanised and intumescent steel I-beams steel I-beams painted with Intumescent paint that translate the structural grid of the external façade into the internal freestanding circular columns

The threshold to the landscape consists of a frameless double-glazed façade with structural supporting fins corresponding with the structural grid.

The development of the auditorium structure was significantly influenced by both the conceptual intentions and specific acoustic requirements. The primary structure consists of three continuous circular steel channels, manufactured from hot-formed galvanised steel plates welded to the required form and depth, and supported by the six circular steel columns. The secondary structure, a light gauge steel framework, supports the internal and external envelope of the auditorium structure. It consists of an exterior galvanised roof with concealed fixings with saligna interior cladding to acoustic requirements.

The use of channels instead of I-beams allows the central continuous beams to be separated by neoprene components for acoustic considerations. See Figure 8.21 for a detailed section through the steel channels. The sound lobby links, connecting the circulation within the structural and service core as well as waiting spaces to the auditorium entrance is constructed of soundproof and fire resistant glazing and emphasises the loose placement of the auditorium structure as well as the vertical spatial relationship throughout the core through its complete transparent appearance.

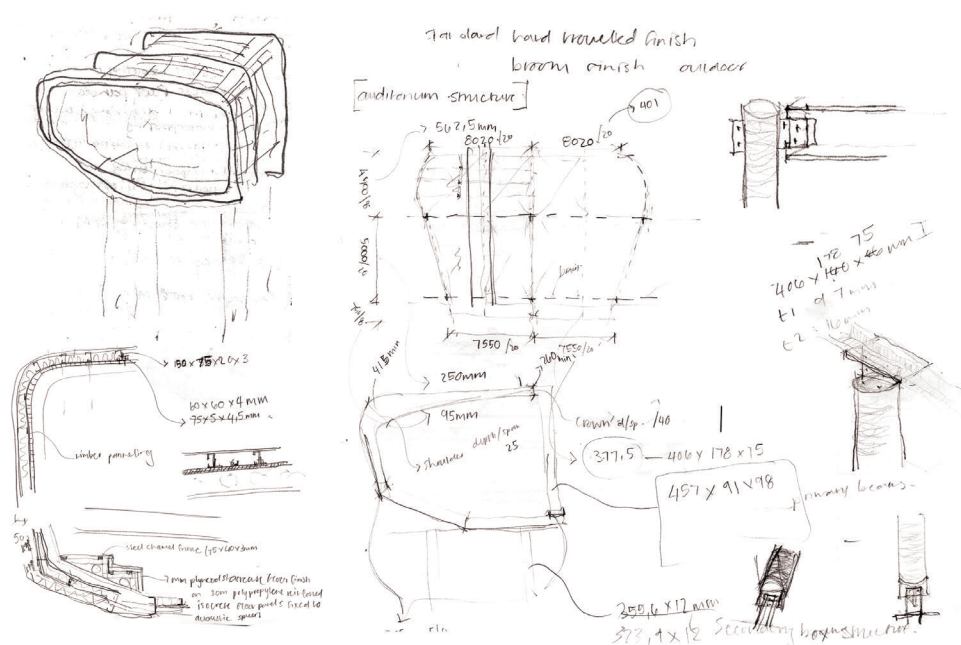
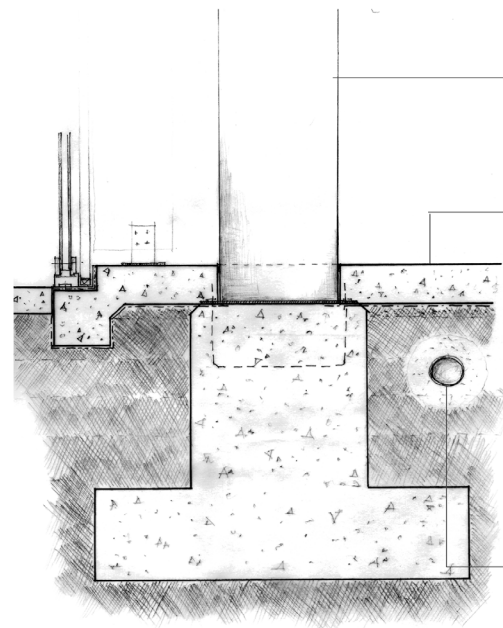
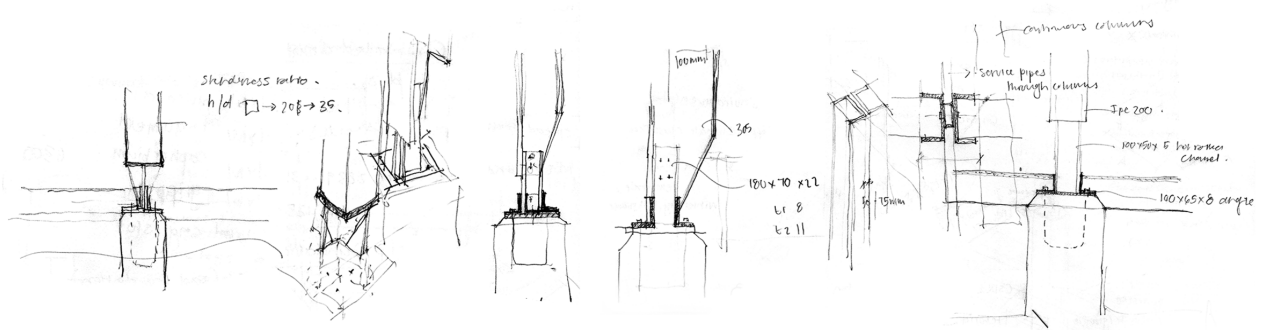


Figure 8.18: Development of the auditorium structure (Author 2015)



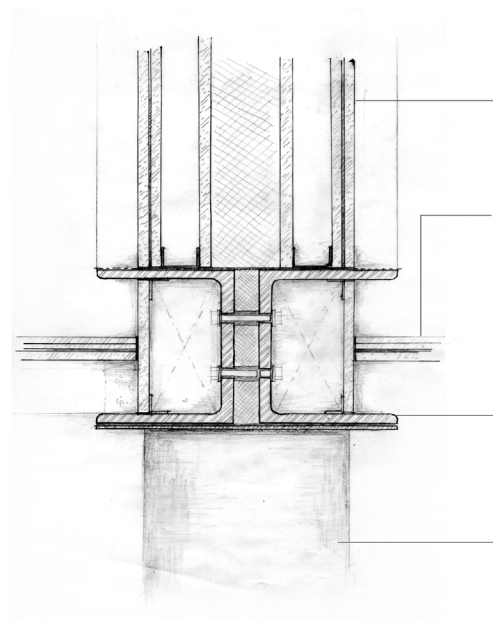
406mm x 8mm Galvanised and intumescent painted circular steel columns at 5000mm x 8000mm c/c spacing, welded to a 6mm base plate, bolted to the concrete footing with a hot-rolled steel U-bolt

150mm Power floated cast-in-situ reinforced concrete surface bed according to engineer's specification, with silicone sealed v-joint as isolation joints around circular steel columns and expansion joints at maximum 3000mm x 4000mm intervals to line up with isolation joints and beam structure above

Surface bed to be laid on a Green co ex 250µm damp proof membrane Type C laid with minimum 150mm overlaps and sealed with pressure sensitive tape. DPM on 50mm sandblinding on 150mm layers of well compacted ground / fill to replace existing clay as specified by the engineer.

110mm Ø subsoil drain

Figure 8.19: Detail of the concrete footing, surface bed and circular steel column connection (Author 2015)



100mm x 22mm Saligna wall planks, fixed to a 9mm Magnesium Oxide board with rubber acoustic separating layer, bolted to 78mm x 50mm galvanised cold formed channel framework as wall studs, with an internal fibre cement board for added fire resistance, with a 150mm thick Polyisocyanurate insulation

21mm Sealed plywood floor on a 9mm Magnesium Oxide board on a rubber acoustic separating layer, on a 21mm plywood, separated from the galvanised cold formed light steel floor structure with 25mm x 25mm timber acoustic spacers on a rubber sleeve

Continuous custom Galvanised steel channel as primary structure, between 356mm and 750mm deep, with 300mm flanges, at 8000mm c/c spacing maximum, bolted to the base plate with a neoprene separating sleeve for acoustic purposes

Steel channels to be bolted back to back with a neoprene gasket and 50mm thick Polyisocyanurate insulation for acoustic purposes

406mm x 8mm Galvanised and intumescent painted circular steel columns at 5000mm x 8000mm c/c spacing

Figure 8.20 Detail cross section through the auditorium central steel channels (Author 2015)

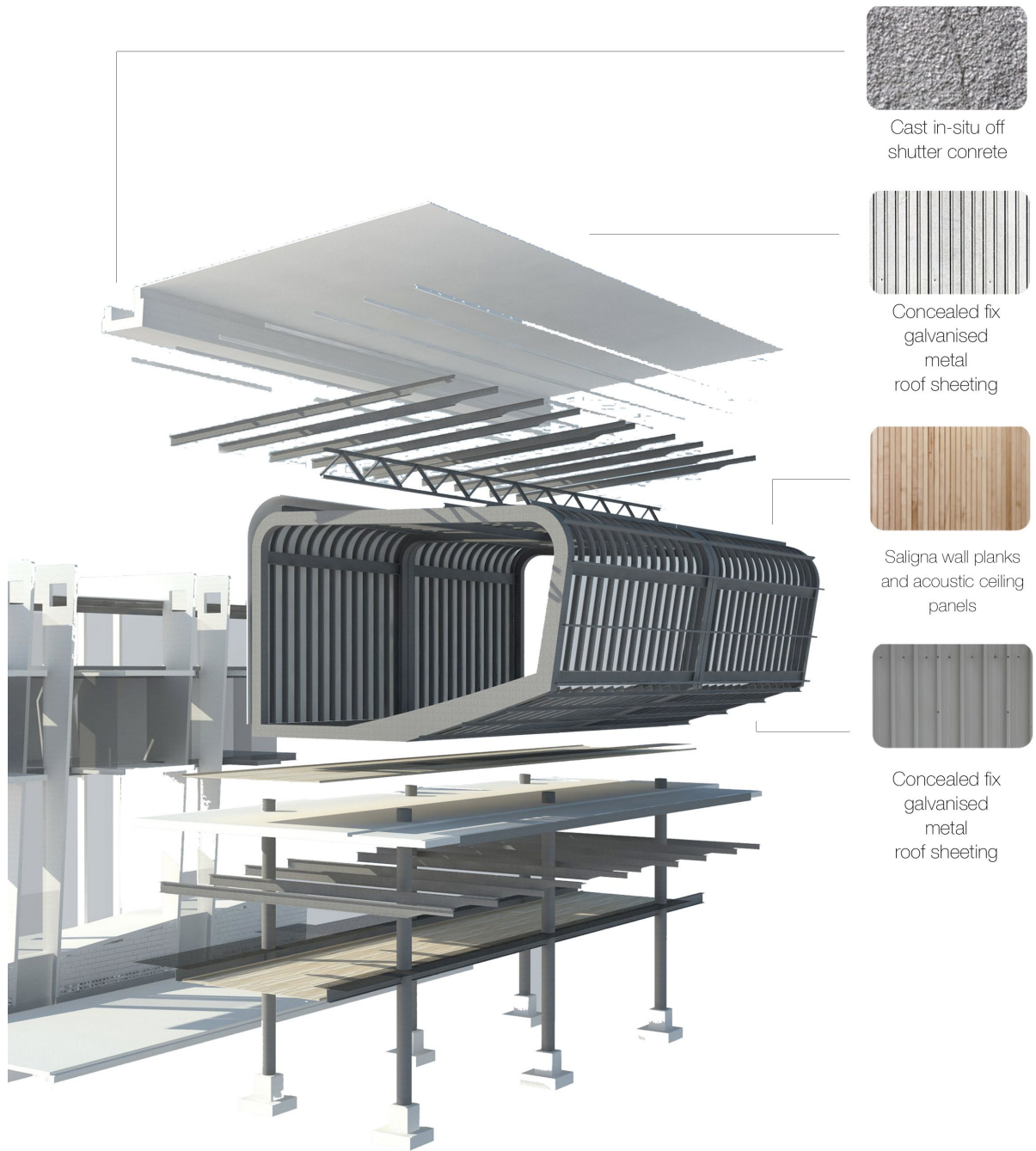


Figure 8.21: Detailed section of the auditorium structure (Author 2015)

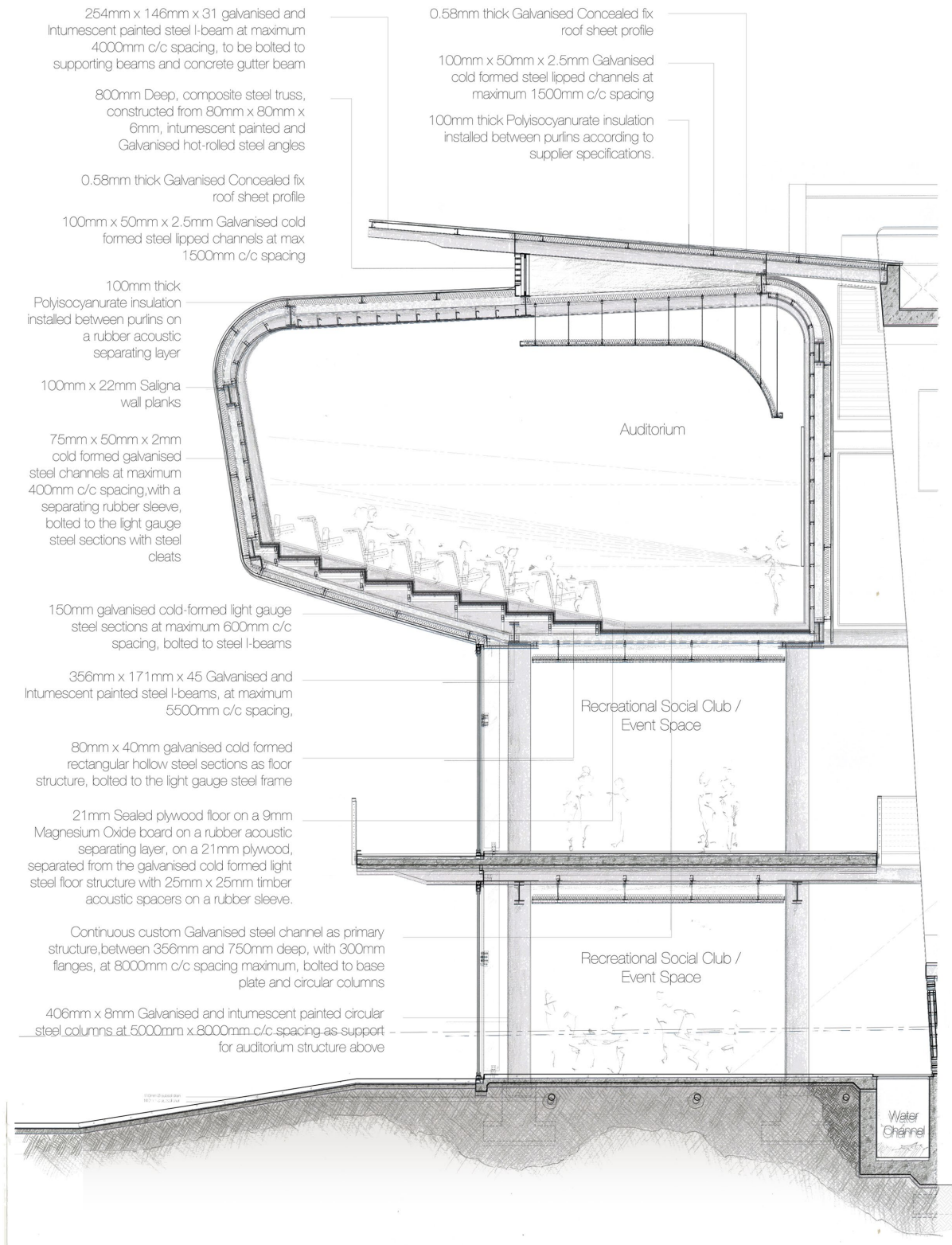


Figure 8.22: Detailed section of the auditorium structure. (Author 2015)

8.6

Water as Service and Environmental System

The reinvention of existing and new infrastructure with a focus on water systems and processes from the outset of the project is continued to the environmental systems and services of the site and building. The approach of the project is to employ a decentralised strategy of service areas that harvest and re-use rainwater locally and are unified and equalised through the ground water channel, wetland and reservoir system that harvests, treats, conveys and stores stormwater runoff as well as re-cycled greywater.

Harvested rainwater as well as water from the reservoir is used for services such as the flushing of water closets and irrigation of the productive greenhouses and recreational landscape, as well as environmental systems such as indirect evaporative cooling strategies during summer and water heating strategies during winter. All treated surplus yield is fed back into the Apies River, extending the influence of the ecological potential to the scale of the river, providing a quantitative and qualitative improvement to the river that supports agricultural production on the northern boundaries of the city.

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

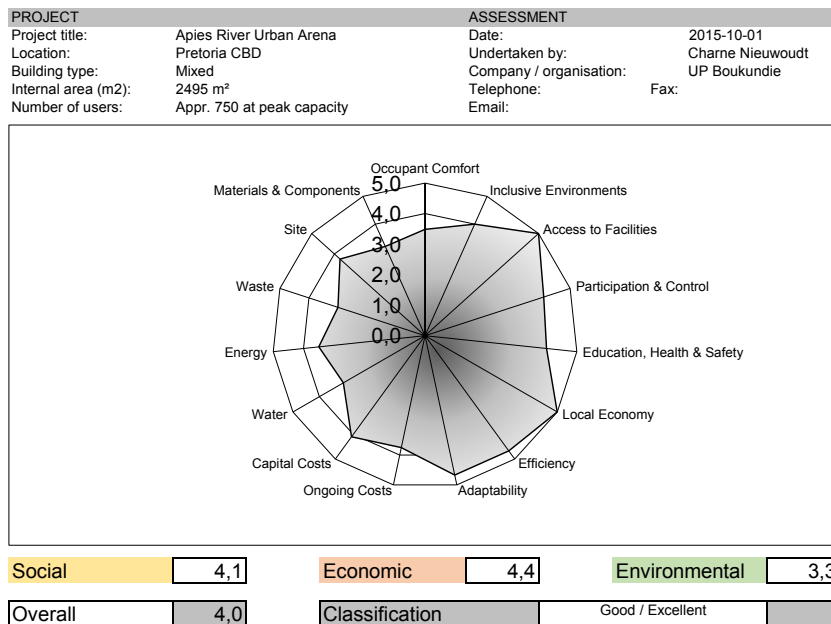


Figure 8.23: SBAT investigation of the site's sustainability potential (Author 2015)

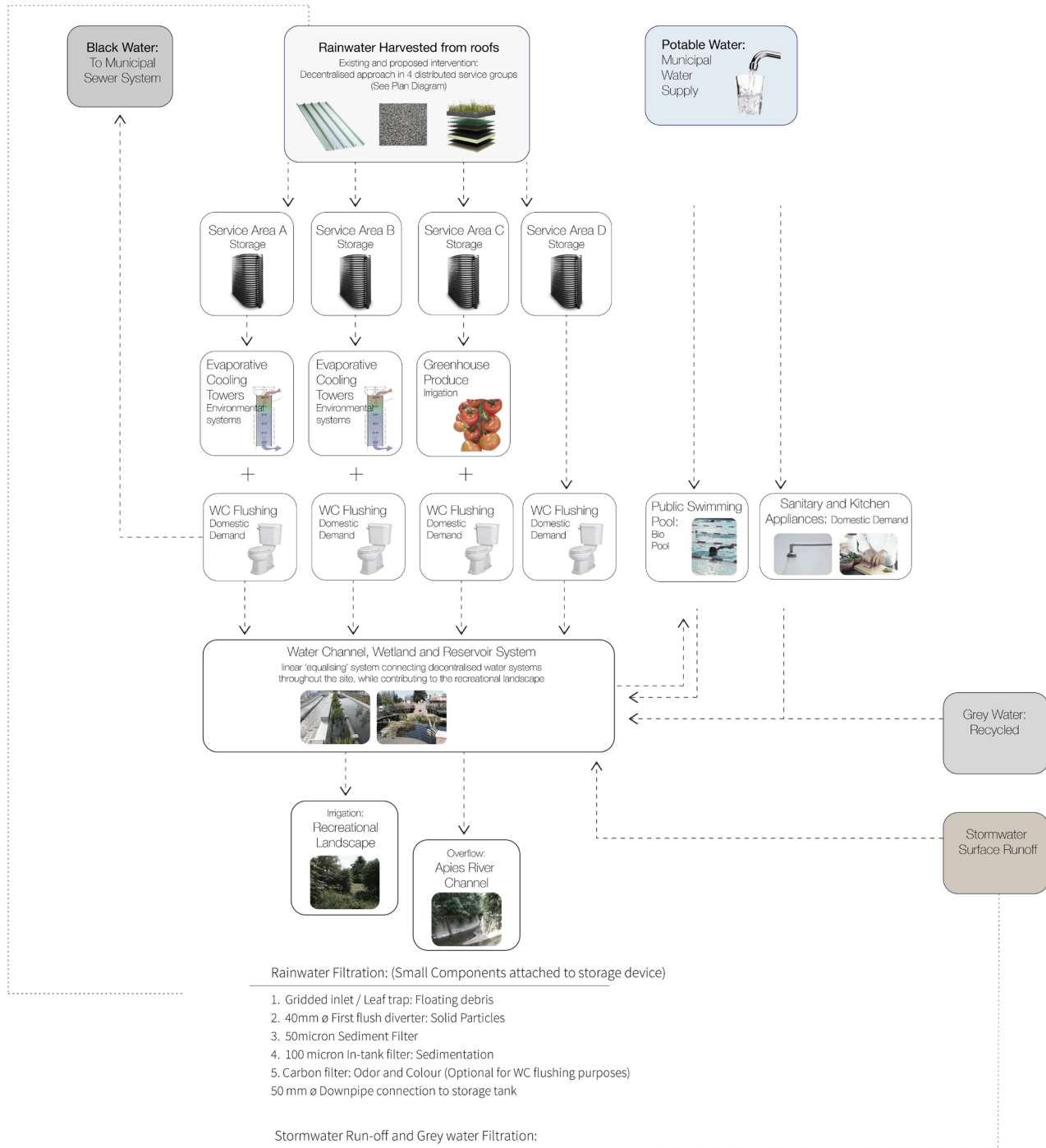
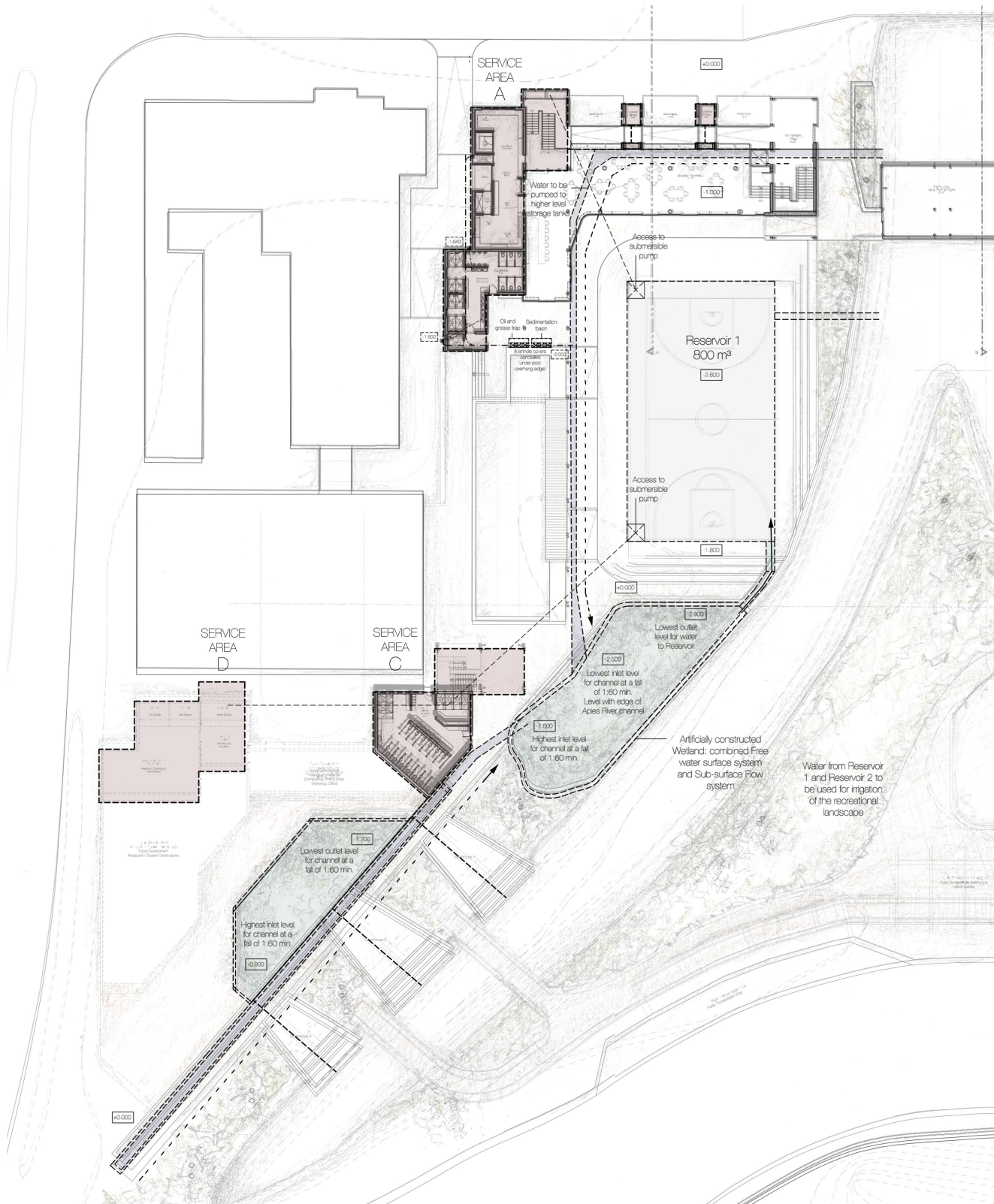
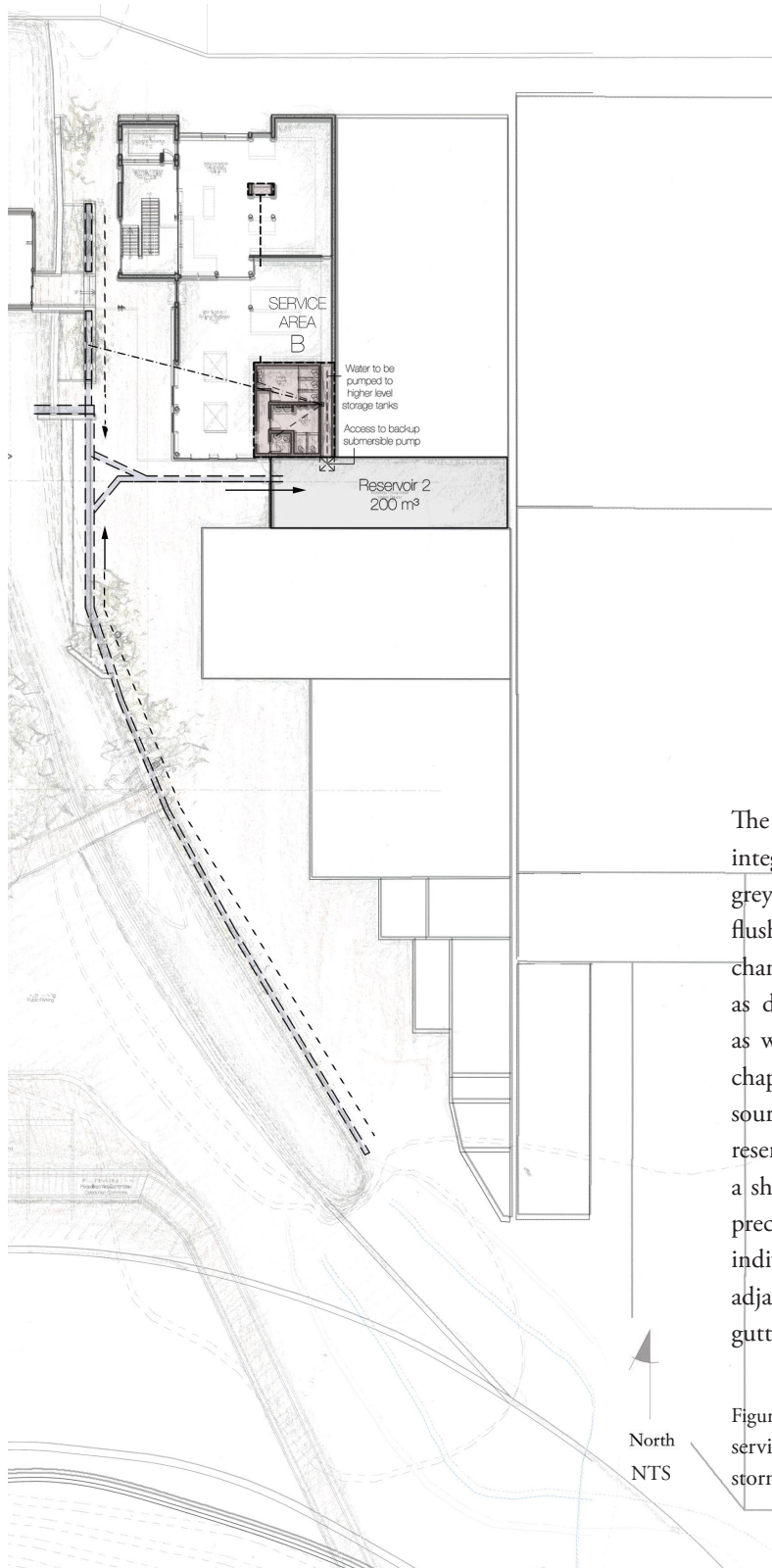


Figure 8.24: Diagramme of the integration of water services and environmental systems of the site. (Author 2015)





The water strategy at ground level is proposed as an integration system for all treated stormwater runoff, greywater recycled and surplus rainwater not used for WC flushing or environmental systems. The constructed water channel as continuous organisational and animating entity as discussed in the design development chapter (eight) as well as sub-section 9.3 of the technical development chapter, collects all treated water from the three different sources to be diverted to the wetland and stored in the reservoirs for supplementing the service area demands with a shortage of rainwater as well as reuse within the larger precinct. The western and eastern parts of the site have individual ground level systems that provide to both their adjacent precincts. The building structure and continuous gutter integrates the two systems at roof level.

Figure 8.25: Site diagramme illustrating the integrated water services and systems throughout the site, including rainwater, stormwater runoff and greywater. (Author 2015)

| Water Supply | | | |
|---|----------------------------|----------------------------|---------------------------------|
| Roof Rainwater yield calculation - Service Area A | | | |
| | Avg. monthly precipitation | Area of catchment weighted | Total Roof Rainwater yield (m³) |
| January | 0,104 | 1402,698 | 145,880592 |
| February | 0,113 | 1402,698 | 158,504874 |
| March | 0,083 | 1402,698 | 116,423934 |
| April | 0,044 | 1402,698 | 61,718712 |
| May | 0,018 | 1402,698 | 25,248564 |
| June | 0,009 | 1402,698 | 12,624282 |
| July | 0,004 | 1402,698 | 5,610792 |
| August | 0,003 | 1402,698 | 4,208094 |
| September | 0,021 | 1402,698 | 29,456658 |
| October | 0,071 | 1402,698 | 99,591558 |
| November | 0,108 | 1402,698 | 151,491384 |
| December | 0,108 | 1402,698 | 151,491384 |
| Total | 0,686 | 16832,376 | 962,250828 |

| | Environmental Systems Demand | Domestic demand |
|-----------|------------------------------|-----------------|
| January | 17,67 | 104,398 |
| February | 17,1 | 96,064 |
| March | 17,67 | 104,398 |
| April | 11,4 | 101,62 |
| May | 5,7 | 104,398 |
| June | 0 | 101,62 |
| July | 0 | 104,398 |
| August | 0 | 104,398 |
| September | 5,7 | 101,62 |
| October | 11,4 | 104,398 |
| November | 17,1 | 101,62 |
| December | 17,67 | 104,398 |

| Water Supply | | | |
|---|----------------------------|----------------------------|---------------------------------|
| Roof Rainwater yield calculation - Service Area B | | | |
| | Avg. monthly precipitation | Area of catchment weighted | Total Roof Rainwater yield (m³) |
| January | 0,104 | 1320,72 | 137,35488 |
| February | 0,113 | 1320,72 | 149,24136 |
| March | 0,083 | 1320,72 | 109,61976 |
| April | 0,044 | 1320,72 | 58,11168 |
| May | 0,018 | 1320,72 | 23,77296 |
| June | 0,009 | 1320,72 | 11,88648 |
| July | 0,004 | 1320,72 | 5,28288 |
| August | 0,003 | 1320,72 | 3,96216 |
| September | 0,021 | 1320,72 | 27,73512 |
| October | 0,071 | 1320,72 | 93,77112 |
| November | 0,108 | 1320,72 | 142,63776 |
| December | 0,108 | 1320,72 | 142,63776 |
| Total | 0,686 | 15848,64 | 10872,16704 |

| | Environmental Systems Demand | Domestic demand |
|-----------|------------------------------|-----------------|
| January | 14,26 | 19,964 |
| February | 13,8 | 18,032 |
| March | 14,26 | 19,964 |
| April | 9,2 | 19,32 |
| May | 6,9 | 19,964 |
| June | 0 | 19,32 |
| July | 0 | 19,964 |
| August | 0 | 19,964 |
| September | 6,9 | 19,32 |
| October | 9,2 | 19,964 |
| November | 13,8 | 19,32 |
| December | 14,26 | 19,964 |

| Water Supply | | | |
|---|----------------------------|----------------------------|---------------------------------|
| Roof Rainwater yield calculation - Service Area C | | | |
| | Avg. monthly precipitation | Area of catchment weighted | Total Roof Rainwater yield (m³) |
| January | 0,104 | 1039,95 | 108,1548 |
| February | 0,113 | 1039,95 | 117,51435 |
| March | 0,083 | 1039,95 | 86,31585 |
| April | 0,044 | 1039,95 | 45,7578 |
| May | 0,018 | 1039,95 | 18,7191 |
| June | 0,009 | 1039,95 | 9,35955 |
| July | 0,004 | 1039,95 | 4,1598 |
| August | 0,003 | 1039,95 | 3,11985 |
| September | 0,021 | 1039,95 | 21,83895 |
| October | 0,071 | 1039,95 | 73,83645 |
| November | 0,108 | 1039,95 | 112,3146 |
| December | 0,108 | 1039,95 | 112,3146 |
| Total | 0,686 | 12479,4 | 8560,8684 |

| | Irrigation Demands | Domestic demand |
|-----------|--------------------|-----------------|
| January | 31,8 | 58,821 |
| February | 27,295 | 49,364 |
| March | 26,765 | 58,821 |
| April | 22,525 | 58,1 |
| May | 22,525 | 58,821 |
| June | 18,55 | 58,1 |
| July | 15,9 | 58,821 |
| August | 18,55 | 58,821 |
| September | 26,5 | 58,1 |
| October | 26,5 | 58,821 |
| November | 30,475 | 58,1 |
| December | 31,8 | 58,821 |

Table 8.3: Water calculations of Service Areas A, B and C
(Author 2015)

Service Group A - Water Budget
Total Yield and Demand to be used from Rainwater (m³)

| Total Rainwater demand | Total Rainwater Yield | Balance | Water to be pumped from / released to Reservoir | Left over in tank y1 | Water to be pumped / released from / to Reservoir | Left over in tank y2 |
|------------------------|-----------------------|-------------|---|----------------------|---|----------------------|
| 122,068 | 145,880592 | 23,812592 | 0 | 23,812592 | -40 | 39,32342 |
| 113,164 | 158,504874 | 45,340874 | -7 | 62,153466 | -40 | 44,664294 |
| 122,068 | 116,423934 | -5,644066 | 0 | 56,5094 | 0 | 39,020228 |
| 113,02 | 61,718712 | -51,301288 | 55 | 60,208112 | 55 | 42,71894 |
| 110,098 | 25,248564 | -84,849436 | 80 | 55,358676 | 80 | 37,869504 |
| 101,62 | 12,624282 | -88,995718 | 80 | 46,362958 | 80 | 28,873786 |
| 104,398 | 5,610792 | -98,787208 | 80 | 27,57575 | 80 | 10,086578 |
| 104,398 | 4,208094 | -100,189906 | 80 | 7,385844 | 80 | -10,103328 |
| 107,32 | 29,456658 | -77,863342 | 80 | 9,522502 | 80 | -7,96667 |
| 115,798 | 99,591558 | -16,206442 | 0 | -6,68394 | 0 | -24,173112 |
| 118,72 | 151,491384 | 32,771384 | 0 | 26,087444 | 0 | 8,598272 |
| 122,068 | 151,491384 | 29,423384 | 0 | 55,510828 | 0 | 38,021656 |

Service Group B - Water Budget
Total Yield and Demand to be used from Rainwater (m³)

| Total Rainwater demand | Total Rainwater Yield | Balance | Water to be pumped / released from / to Reservoir | Left over in tank y1 | Water to be pumped / released from / to Reservoir | Left over in tank y2 |
|------------------------|-----------------------|-----------|---|----------------------|---|----------------------|
| 34,224 | 137,35488 | 103,13088 | -40 | 63,13088 | -70 | 56,5048 |
| 31,832 | 149,24136 | 117,40936 | -120 | 60,54024 | -115 | 58,91416 |
| 34,224 | 109,61976 | 75,39576 | -75 | 60,936 | -75 | 59,30992 |
| 28,52 | 58,11168 | 29,59168 | -30 | 60,52768 | -30 | 58,9016 |
| 26,864 | 23,77296 | -3,09104 | -10 | 47,43664 | -10 | 45,81056 |
| 19,32 | 11,88648 | -7,43352 | 0 | 40,00312 | 0 | 38,37704 |
| 19,964 | 5,28288 | -14,68112 | 0 | 25,322 | 0 | 23,69592 |
| 19,964 | 3,96216 | -16,00184 | 0 | 9,32016 | 0 | 7,69408 |
| 26,22 | 27,73512 | 1,51512 | 0 | 10,83528 | 0 | 9,2092 |
| 29,164 | 93,77112 | 64,60712 | -50 | 25,4424 | -50 | 23,81632 |
| 33,12 | 142,63776 | 109,51776 | -120 | 14,96016 | -120 | 13,33408 |
| 34,224 | 142,63776 | 108,41376 | -100 | 23,37392 | -100 | 21,74784 |

Service Group C - Water Budget
Total Yield and Demand to be used from Rainwater (m³)

| Total Rainwater demand | Total Rainwater Yield | Balance | Water to be pumped / released from / to Reservoir | Left over in tank y1 | Water to be pumped / released from / to Reservoir | Left over in tank y2 |
|------------------------|-----------------------|-----------|---|----------------------|---|----------------------|
| 90,621 | 108,1548 | 17,5338 | 0 | 17,5338 | -15 | 58,2435 |
| 76,659 | 117,51435 | 40,85535 | 0 | 58,38915 | -40 | 59,09885 |
| 85,586 | 86,31585 | 0,72985 | 0 | 59,119 | 0 | 59,8287 |
| 80,625 | 45,7578 | -34,8672 | 10 | 34,2518 | 0 | 24,9615 |
| 81,346 | 18,7191 | -62,6269 | 50 | 21,6249 | 60 | 22,3346 |
| 76,65 | 9,35955 | -67,29045 | 70 | 24,33445 | 60 | 15,04415 |
| 74,721 | 4,1598 | -70,5612 | 70 | 23,77325 | 70 | 14,48295 |
| 77,371 | 3,11985 | -74,25115 | 70 | 19,5221 | 70 | 10,2318 |
| 84,6 | 21,83895 | -62,76105 | 65 | 21,76105 | 65 | 12,47075 |
| 85,321 | 73,83645 | -11,48455 | 0 | 10,2765 | 10 | 10,9862 |
| 88,575 | 112,3146 | 23,7396 | 0 | 34,0161 | 0 | 34,7258 |
| 90,621 | 112,3146 | 21,6936 | 0 | 55,7097 | 0 | 56,4194 |

Rainwater harvested from the existing and proposed roof structures are collected, treated and stored at roof level for the use of WC flushing and the indirect evaporative cooling towers. The surplus rainwater from service area B are conveyed to the ground water channel system. Water is pumped from the reservoir to additional storage tanks at roof level for Service Areas A, C and D with a shortage of rainwater harvested. Table 9.1 and Table 9.2 illustrates the rainwater yield and demand at the various service areas as well as the total water budget for the western and eastern ground level water systems.

| Water Supply | | | |
|---|----------------------------|----------------------------|---------------------------------|
| Roof Rainwater yield calculation - Service Area D | | | |
| | Avg. monthly precipitation | Area of catchment weighted | Total Roof Rainwater yield (m³) |
| January | 0,104 | 450 | 46,8 |
| February | 0,113 | 450 | 50,85 |
| March | 0,083 | 450 | 37,35 |
| April | 0,044 | 450 | 19,8 |
| May | 0,018 | 450 | 8,1 |
| June | 0,009 | 450 | 4,05 |
| July | 0,004 | 450 | 1,8 |
| August | 0,003 | 450 | 1,35 |
| September | 0,021 | 450 | 9,45 |
| October | 0,071 | 450 | 31,95 |
| November | 0,108 | 450 | 48,6 |
| December | 0,108 | 450 | 48,6 |
| Total | 0,686 | 5400 | 3704,4 |

| Rainwater Roof Runoff Coefficients: | |
|--|--|
| 0.90 | Sheet Metal, Concrete or asphalt |
| 0,85 - 0,8 | Builtup tar or gravel |
| 0,4 | Green Roof - Lawn Perennial Small Shrub |
| *0,6 coverage | 50/50 Green Roof and gravel / hard landscape |
| (Source: http://www.coolroof toolkit.org/wp-content/uploads/2012/04/Green-Roof-Policy- | |

Table 8.4: Water calculations of Service Areas A, B and C (Author 2015)

| | Environmental Systems Demand | Domestic demand |
|-----------|------------------------------|-----------------|
| January | 0 | 31,682 |
| February | 0 | 28,616 |
| March | 0 | 31,682 |
| April | 0 | 30,66 |
| May | 0 | 31,682 |
| June | 0 | 30,66 |
| July | 0 | 31,682 |
| August | 0 | 31,682 |
| September | 0 | 30,66 |
| October | 0 | 31,682 |
| November | 0 | 30,66 |
| December | 0 | 31,682 |

| | Irrigation Demand Recreational Landscape | Total Demand |
|-----------|--|--------------|
| January | 360 | 360 |
| February | 360 | 360 |
| March | 360 | 360 |
| April | 320 | 320 |
| May | 240 | 240 |
| June | 240 | 240 |
| July | 240 | 240 |
| August | 240 | 240 |
| September | 320 | 320 |
| October | 360 | 360 |
| November | 360 | 360 |
| December | 360 | 360 |

| | Irrigation Demand Recreational Landscape | Total Demand |
|-----------|--|--------------|
| January | 27 | 27 |
| February | 27 | 27 |
| March | 27 | 27 |
| April | 24 | 24 |
| May | 18 | 18 |
| June | 18 | 18 |
| July | 18 | 18 |
| August | 18 | 18 |
| September | 24 | 24 |
| October | 27 | 27 |
| November | 27 | 27 |
| December | 27 | 27 |

Service Group D - Water Budget
Total Yield and Demand to be used from Rainwater (m³)

| Total Rainwater demand | Total Rainwater Yield | Balance | Water to be pumped / released from / to Reservoir | Left over in tank y1 | Water to be pumped / released from / to Reservoir | Left over in tank y2 |
|------------------------|-----------------------|---------|---|----------------------|---|----------------------|
| 31,682 | 46,8 | 15,118 | 0 | 15,118 | -15 | 45,788 |
| 28,616 | 50,85 | 22,234 | 0 | 37,352 | -25 | 43,022 |
| 31,682 | 37,35 | 5,668 | 0 | 43,02 | -5 | 43,69 |
| 30,66 | 19,8 | -10,86 | 0 | 32,16 | 0 | 32,83 |
| 31,682 | 8,1 | -23,582 | 0 | 8,578 | 0 | 9,248 |
| 30,66 | 4,05 | -26,61 | 30 | 11,968 | 30 | 12,638 |
| 31,682 | 1,8 | -29,882 | 30 | 12,086 | 30 | 12,756 |
| 31,682 | 1,35 | -30,332 | 30 | 11,754 | 30 | 12,424 |
| 30,66 | 9,45 | -21,21 | 20 | 10,544 | 20 | 11,214 |
| 31,682 | 31,95 | 0,268 | 0 | 10,812 | 0 | 11,482 |
| 30,66 | 48,6 | 17,94 | 0 | 28,752 | 0 | 29,422 |
| 31,682 | 48,6 | 16,918 | 0 | 45,67 | 0 | 46,34 |

Water Budget (Western Site)
Total Yield and Demand for Wetland Reservoir System (m³)

| Stormwater Surface Run-off Yield | Greywater Recycling Yield | Total Yield | Service Area Demand / Yield | Balance | Reservoir 1 Size | Overflow to Apies River | Overflow to Apies River after Y1 | Overflow to Apies River after Y2 |
|----------------------------------|---------------------------|-------------|-----------------------------|------------|------------------|-------------------------|----------------------------------|----------------------------------|
| 227,7236 | 479,108 | 706,8316 | 0 | 346,8316 | 800 | -453,1684 | 2238,4425 | 346,8316 |
| 247,43045 | 441,52 | 688,95045 | -7 | 682,78205 | 800 | -117,21795 | 229,61365 | 682,78205 |
| 181,74095 | 479,108 | 660,84895 | 0 | 983,631 | 800 | 183,631 | 866,41305 | 983,631 |
| 96,3446 | 460,91 | 557,2546 | 65 | 1155,8856 | 800 | 355,8856 | 1339,5166 | 1155,8856 |
| 39,4137 | 479,108 | 518,5217 | 130 | 1304,4073 | 800 | 504,4073 | 1660,2929 | 1304,4073 |
| 19,70685 | 460,91 | 480,61685 | 180 | 1365,02415 | 800 | 565,02415 | 1869,43145 | 1365,02415 |
| 8,7586 | 479,108 | 487,8666 | 180 | 1432,89075 | 800 | 632,89075 | 1997,9149 | 1432,89075 |
| 6,56895 | 479,108 | 485,67695 | 180 | 1498,5677 | 800 | 698,5677 | 2131,45845 | 1498,5677 |
| 45,98265 | 460,91 | 506,89265 | 165 | 1520,46035 | 800 | 720,46035 | 2219,02805 | 1520,46035 |
| 155,46515 | 479,108 | 634,57315 | 0 | 1795,0335 | 800 | 995,0335 | 2515,49385 | 1795,0335 |
| 236,4822 | 460,91 | 697,3922 | 0 | 2132,4257 | 800 | 1332,4257 | 3127,4592 | 2132,4257 |
| 236,4822 | 682,703 | 919,1852 | 0 | 2691,6109 | 800 | 1891,6109 | 4024,0366 | 2691,6109 |

After year 2 the reservoir reaches full capacity: Balance to overflow

Water Budget (Eastern Site)
Total Yield and Demand for Wetland Reservoir System (m³)

| Stormwater Surface Run-off Yield | Greywater Recycling Yield | Total Yield | Service Area Demand / Yield | Balance | Reservoir 1 Size | Overflow to Apies River | Overflow to Apies River after Y1 | Overflow to Apies River after Y2 |
|----------------------------------|---------------------------|-------------|-----------------------------|----------|------------------|-------------------------|----------------------------------|----------------------------------|
| 77,22 | 6,82 | 84,04 | -40 | 97,04 | 200 | -102,96 | 749,695 | 97,04 |
| 83,9025 | 6,16 | 90,0625 | -120 | 280,1025 | 200 | 80,1025 | 177,1425 | 280,1025 |
| 61,6275 | 6,82 | 68,4475 | -75 | 396,55 | 200 | 196,55 | 476,6525 | 396,55 |
| 32,67 | 6,6 | 39,27 | -30 | 441,82 | 200 | 241,82 | 638,37 | 441,82 |
| 13,365 | 6,82 | 20,185 | -10 | 454,005 | 200 | 254,005 | 695,825 | 454,005 |
| 6,6825 | 6,6 | 13,2825 | 0 | 449,2875 | 200 | 249,2875 | 703,2925 | 449,2875 |
| 2,97 | 6,82 | 9,79 | 0 | 441,0775 | 200 | 241,0775 | 690,365 | 441,0775 |
| 2,2275 | 6,82 | 9,0475 | 0 | 432,125 | 200 | 232,125 | 673,2025 | 432,125 |
| 15,5925 | 6,6 | 22,1925 | 0 | 430,3175 | 200 | 230,3175 | 662,4425 | 430,3175 |
| 52,7175 | 6,82 | 59,5375 | -50 | 512,855 | 200 | 312,855 | 743,1725 | 512,855 |
| 80,19 | 6,6 | 86,79 | -120 | 692,645 | 200 | 492,645 | 1005,5 | 692,645 |
| 80,19 | 6,82 | 87,01 | -100 | 852,655 | 200 | 652,655 | 1345,3 | 852,655 |

After year 2 the reservoir reaches full capacity: Balance to overflow

Indirect Evaporative Cooling Towers

Environmental systems employed within the building, exploits the potential of water as illustrated in "Figure 8.25: Diagramme of the integration of water services and environmental systems of the site. (Author 2015)" on page 186, through the use of indirect evaporative coolig towers.

The evaporative cooling towers as proposed is contained within the structural and service spine of the building and water is supplied from the storage tanks containing the harvested and treated rainwater.

The structure of the evaporative cooling towers consists of the concrete cast-in situ structural fins, lined with a galvanised steel plate to prevent water penetration or absorption into the concrete fins. The concrete fins are encosed with structural glazing to allow for the visibility and exposure of the cooling system from the internal and external spaces with air supply openings into the adjacent internal spaces. The cooling tower terminates into the constructed water channel at ground floor to capture and drain all excess water away from the internal spaces.

A precedent analysis of Council House 2 in Melbourne, by DesignInc, illustrates the use of this cooling strategy in a similar scale and programmatic condition.

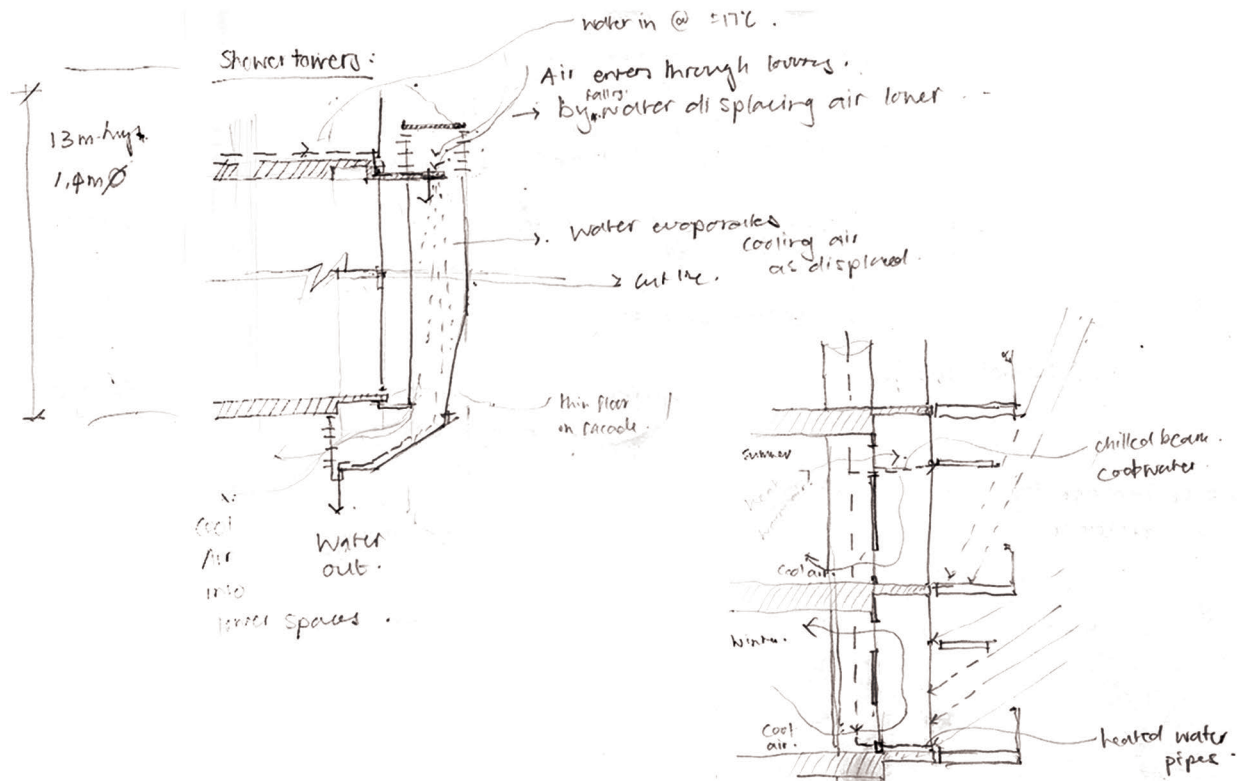


Figure 8.26: Diagrammatic investigation of the cooling tower requirements (Author 2015)

Design Inc, Council House 2 , Melbourne



Figure 8.27: Photograph of the CH2 cooling towers lit up at night, Photo by Dianna Snape (CH2 2013)

Project Information:

Location: Melbourne, Australia

Completion Date: 2006

Client: City of Melbourne

Project team:

Architects: Design Inc

Consultant Team:

Structural and Civil Consultant: Bonacci Group

Relevance: Environmental Systems Employed

Designed as a collaborative project with the City of Melbourne, the aim of CH2 was to create a holistic system that promotes an integrated approach between the city and natural system's potential to passively assist in the activities of the building.

The environmental system focus of this project investigates the indirect evaporative cooling strategy used with water as a coolant through lightweight fabric tubes.



Figure 8.28: Photograph of the air inlets at the top of the cooling towers, Photo by Melbourne Council House, Australia (Ecofriendly architecture 2014)

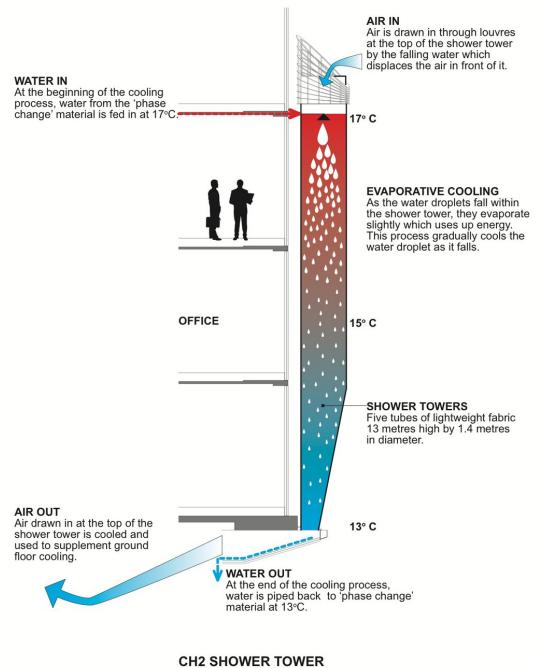


Figure 8.29: Diagrammatic illustration of the cooling towers, by DesignInc (CH2 2013)

Vegetation considerations

Considerations for the artificially constructed wetland, bioswales and greenhouse filtration edges:

- Filtration and nutrient uptake characteristics to be considered. Plant species should be able to be harvested when fully absorbed with nutrients and allow for regrowth.
- Aquatic plant species to be used for areas with permanent or high water levels.
- Wetland plant species to be selected according to seasonal requirements and be able to withstand dry periods.
- Size of plant species to determine aesthetic considerations of the constructed wetland as well as be used as vegetated boundaries to inaccessible areas.
- Planting rehabilitation strategy to be implemented in a phasing process to allow for a successful transition

Potential plant species proposed for the greenhouse filtration edges:

1. Higher edges - Bulrush (Good aesthetic barrier)
2. Lower edges - Schoenoplectus Corymbosis (Higher water levels)

Seasonal plants for the constructed wetland:

3. Aristida Junciformis (Overhanging plants to soften the concrete edges)
4. Calamagrostis Epigejos
5. Erythrina Zeyheri
6. Gunnera Perpensa (Medicinal Potential)



Table Mountain Fern
(Blechnum tabulare)



Crane Flower
(Strelitzia Reginae)



Mountain Saffron
(Scolopia mundii)



Jacaranda
(Jacaranda mimosifolia)



Wild Fig
(Ficus thonningii)



Pomegranate tree
(Punica granatum)



Wild Date Palm
(Phoenix reclinata)

Figure 8.31: Existing vegetation on site to be retained (Author 2015)



English Ivy
(Hedera helix)

Figure 8.32: Existing vegetation on site to be removed (Author 2015)



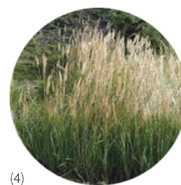
(1)



(2)



(3)



(4)



(5)



(6)

Figure 8.30: Potential proposed plant species to be used (Author 2015)

09

CHAPTER NINE

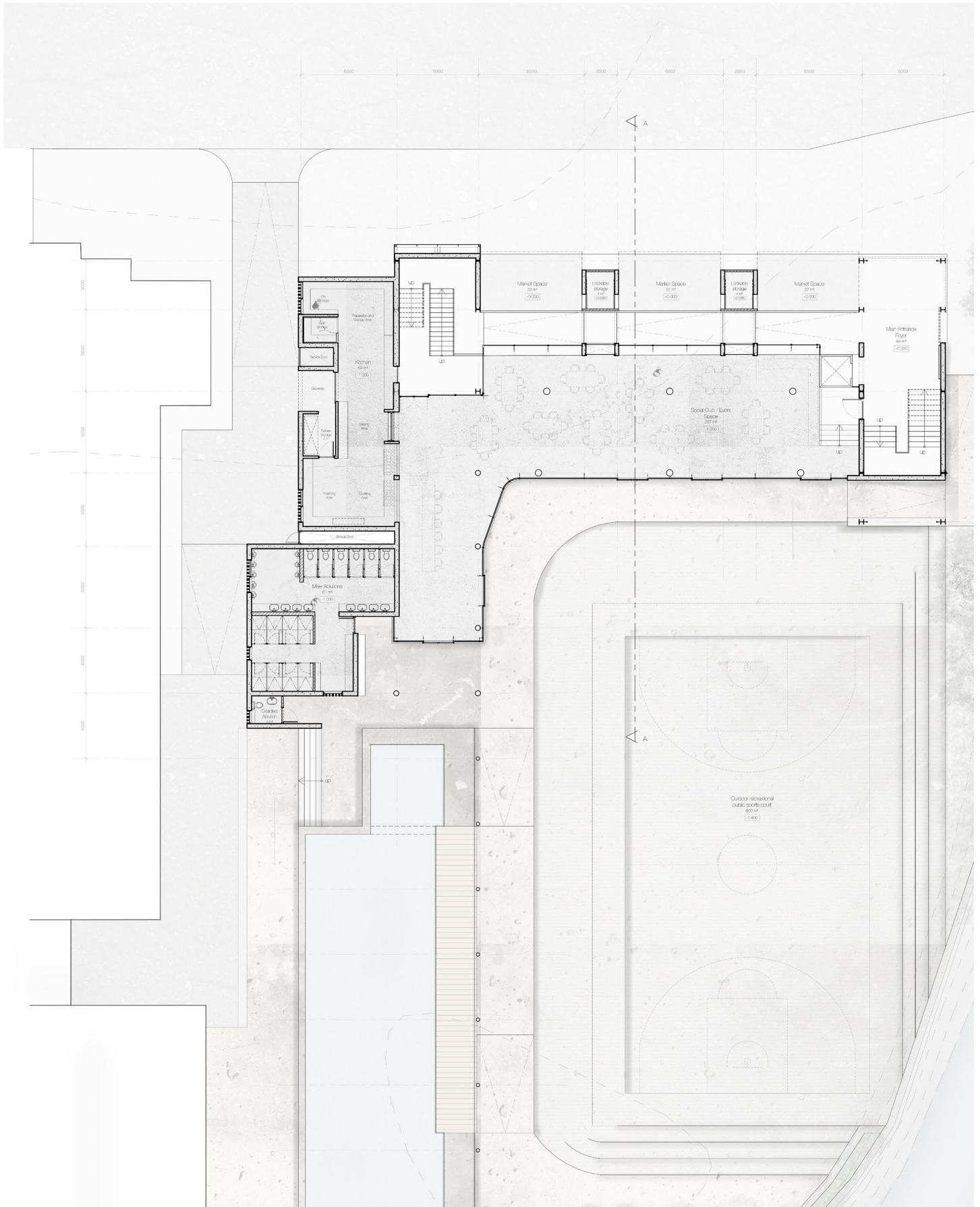
CONCLUSION

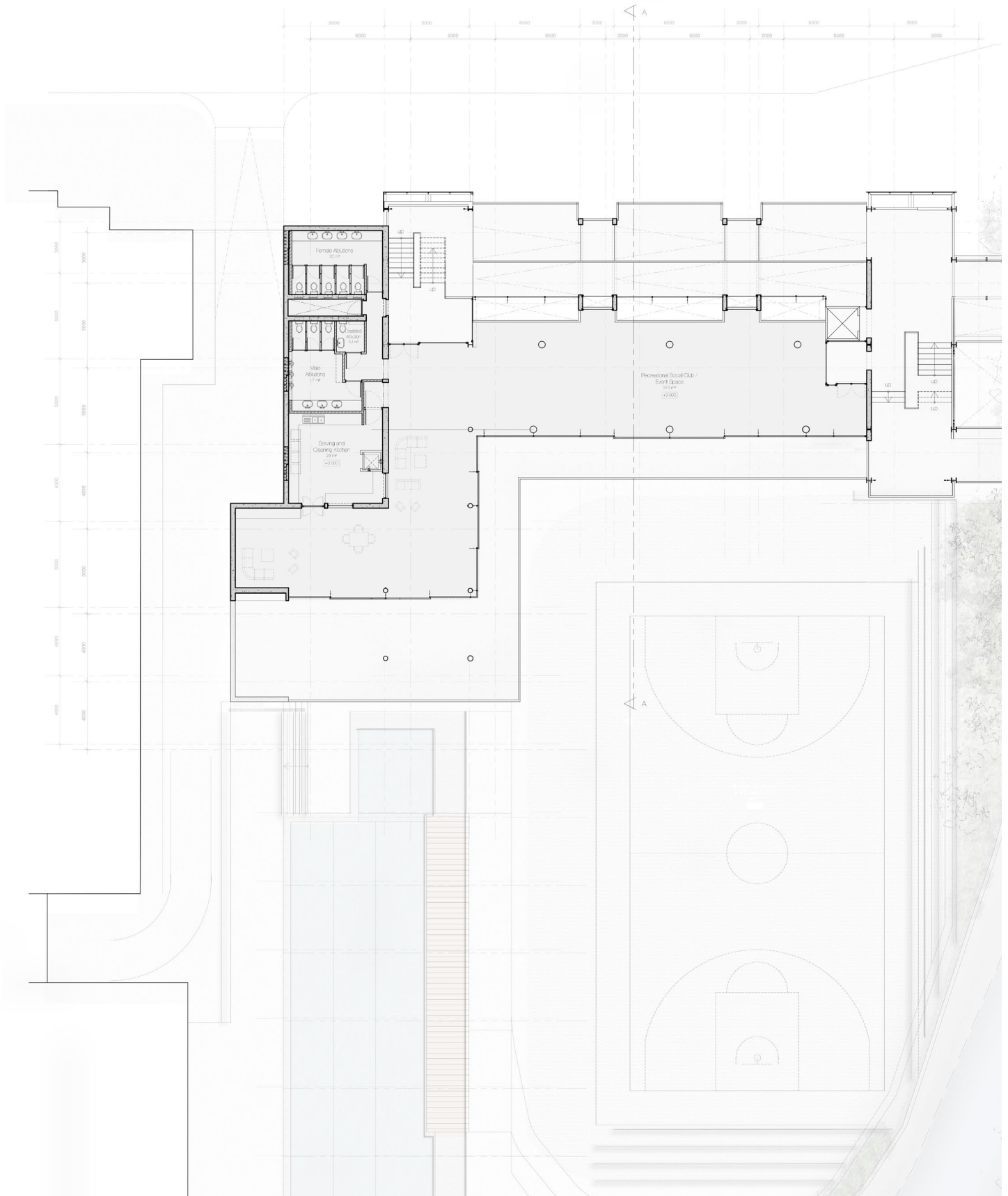
Exhibition Presentation and Photographs
Conclusion

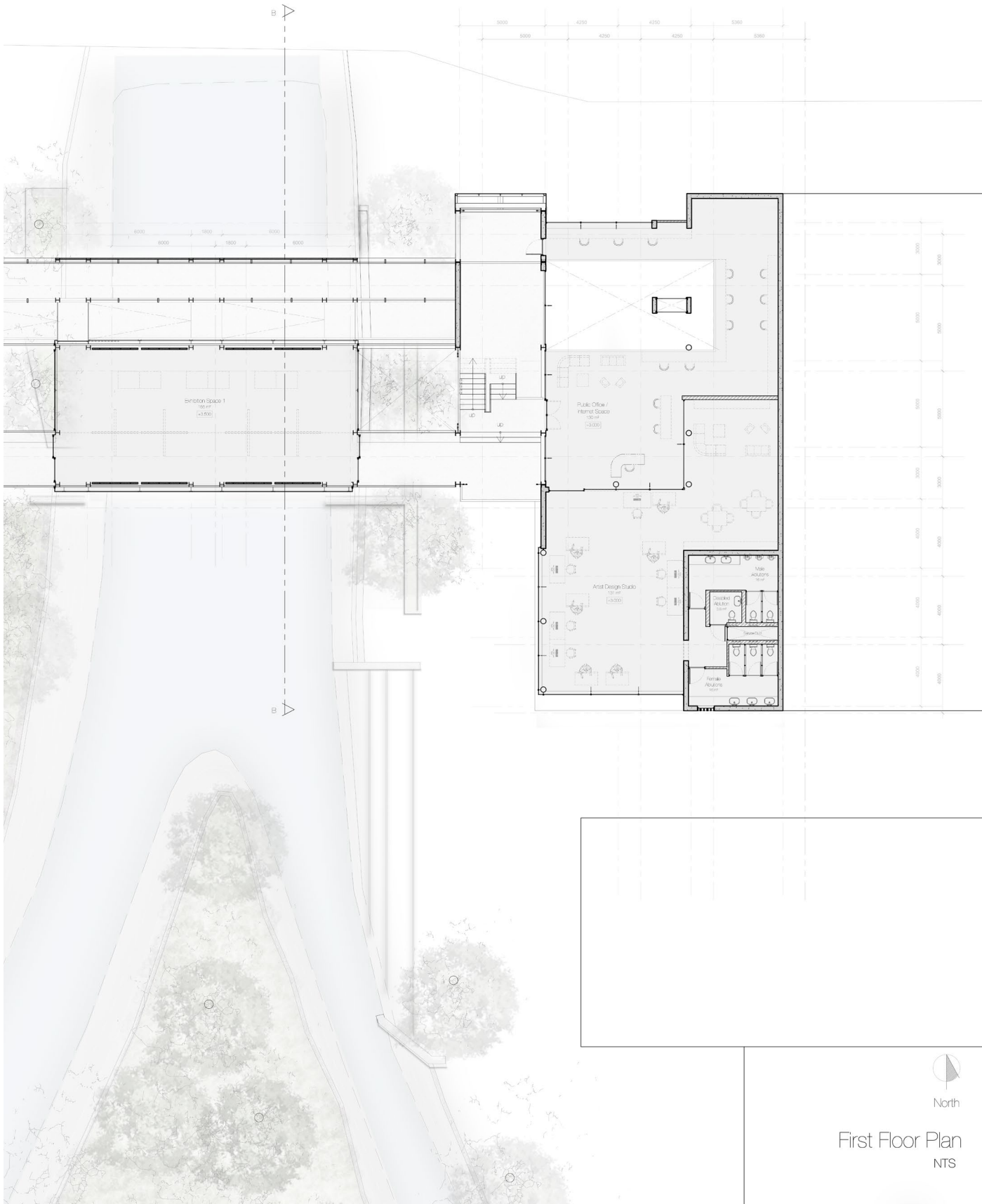
9.1

FINAL PROJECT PROPOSAL:

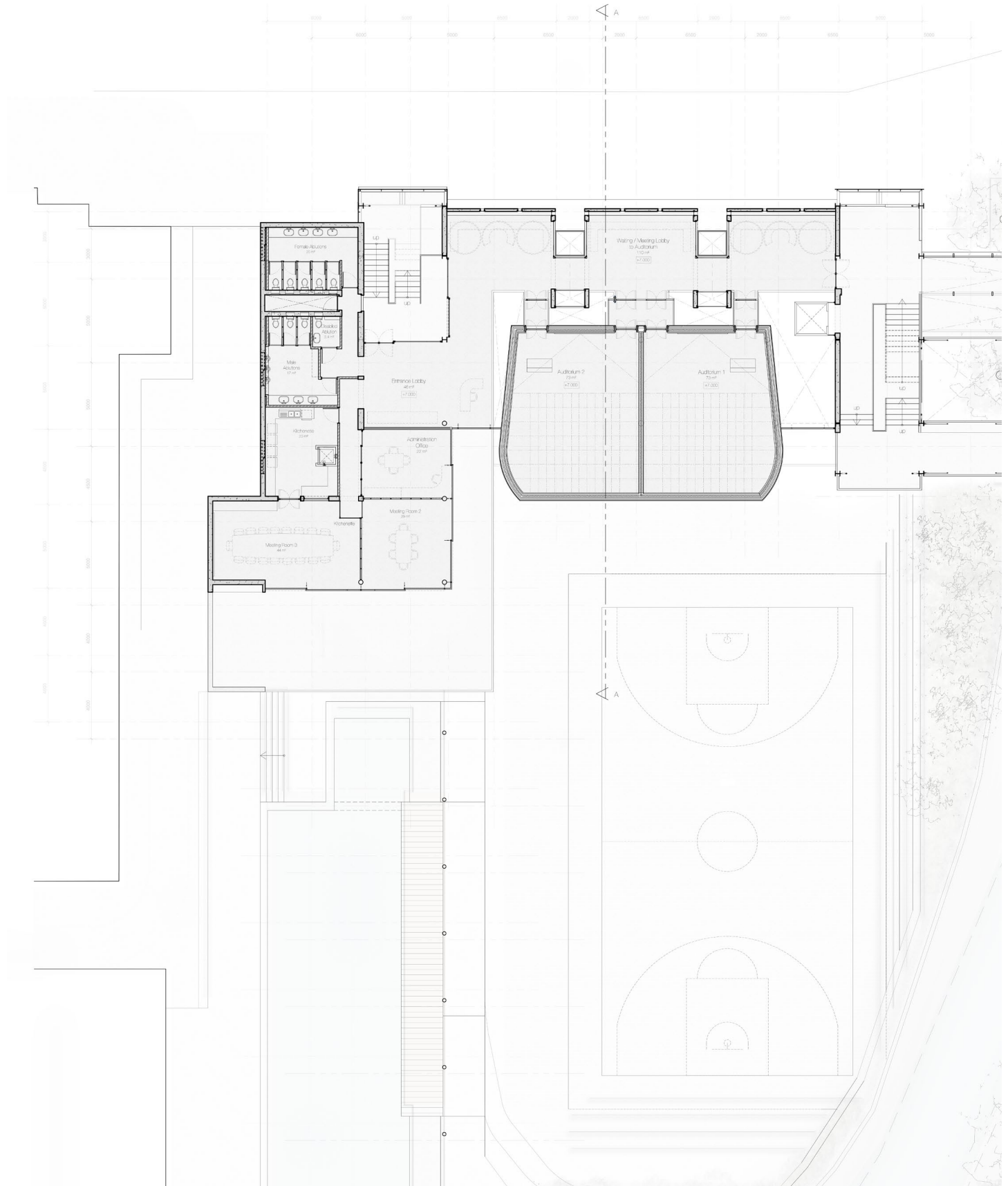
Exhibition drawings and photographs







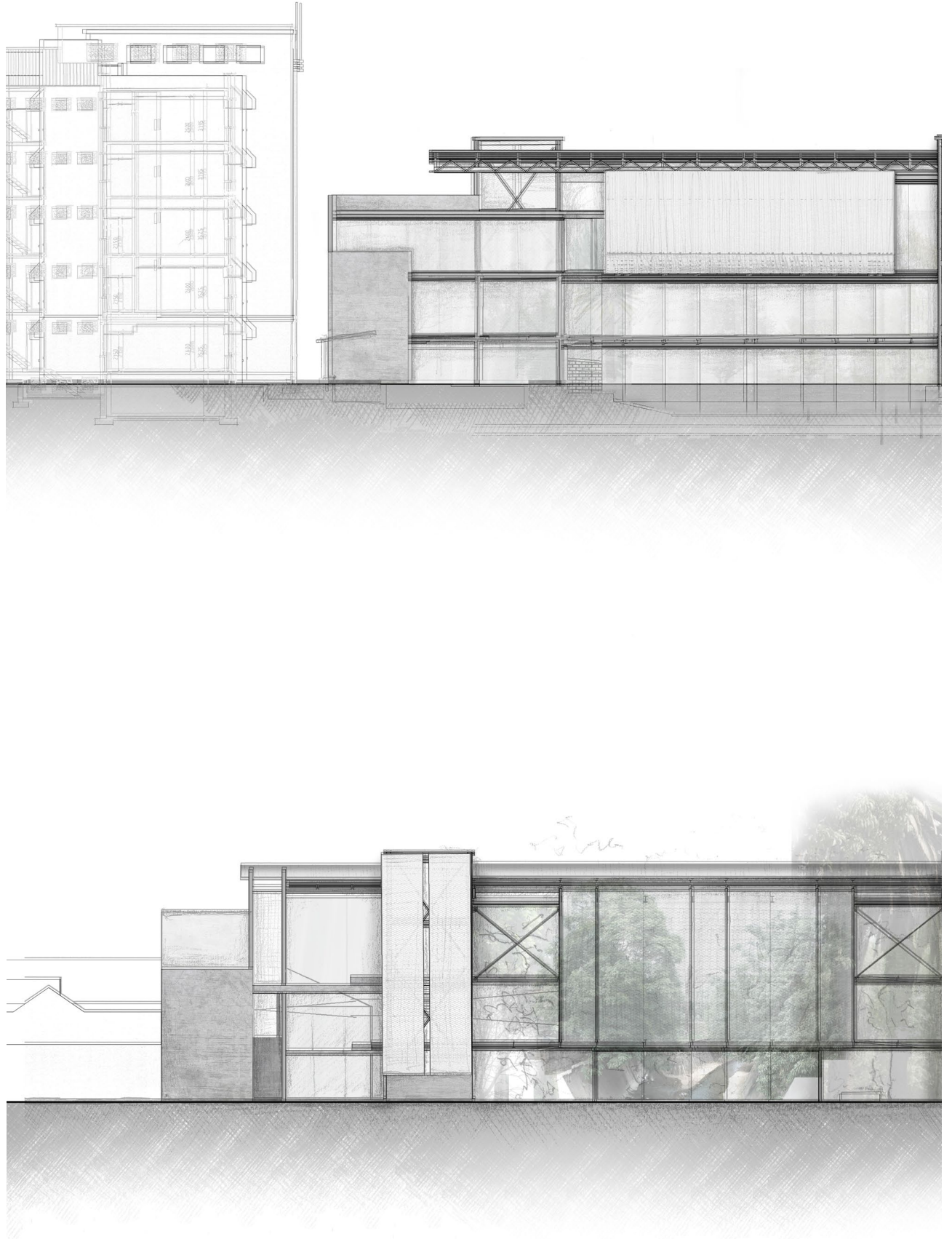
North
First Floor Plan
NTS

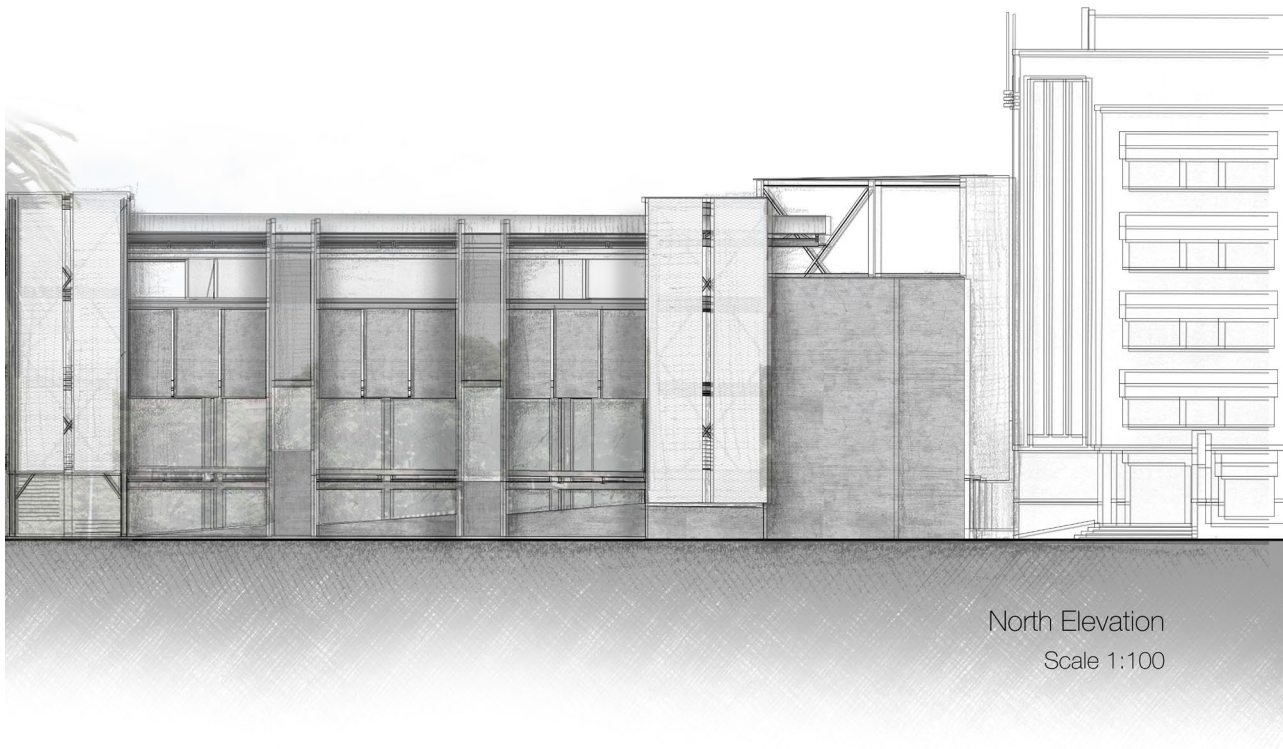
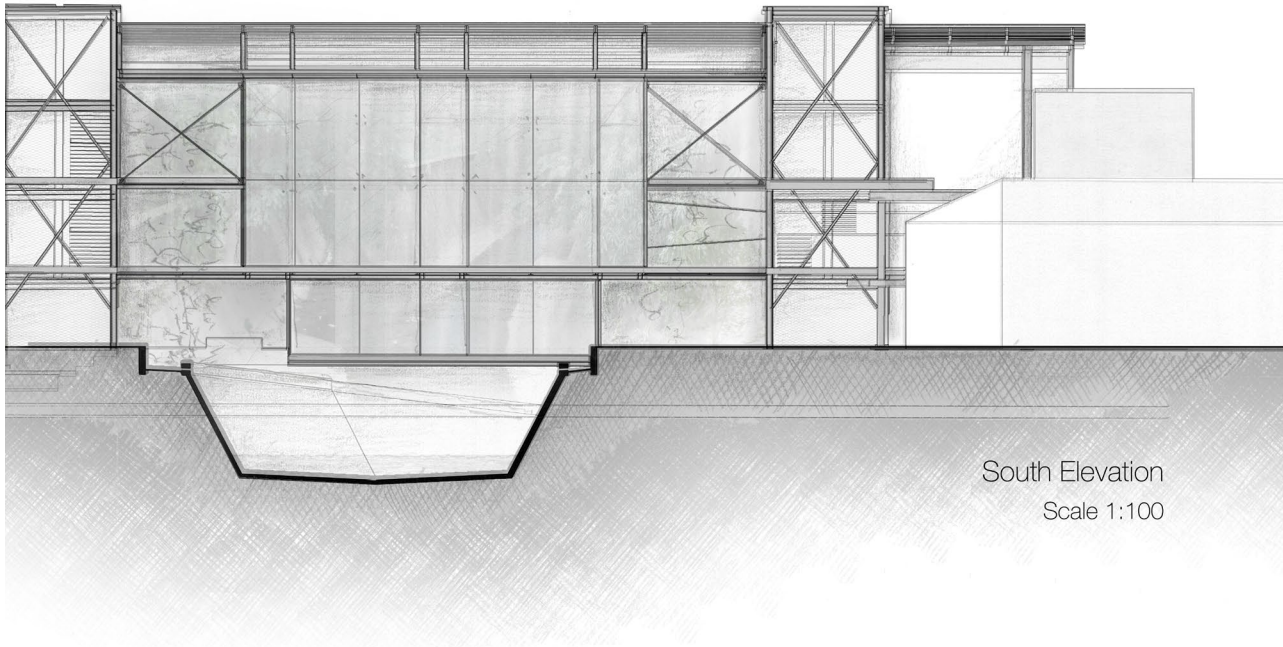




North

Second Floor Plan
NTS

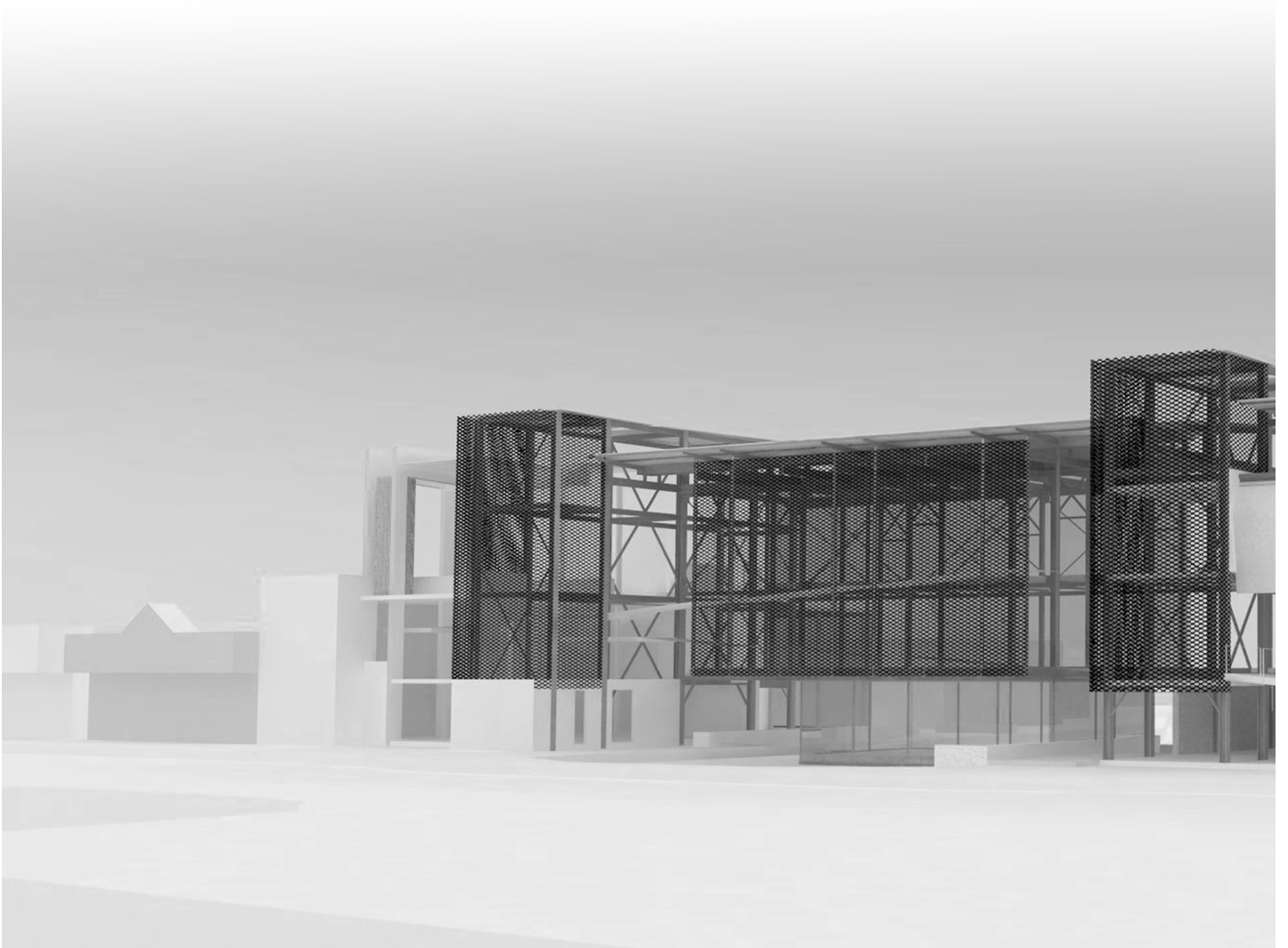


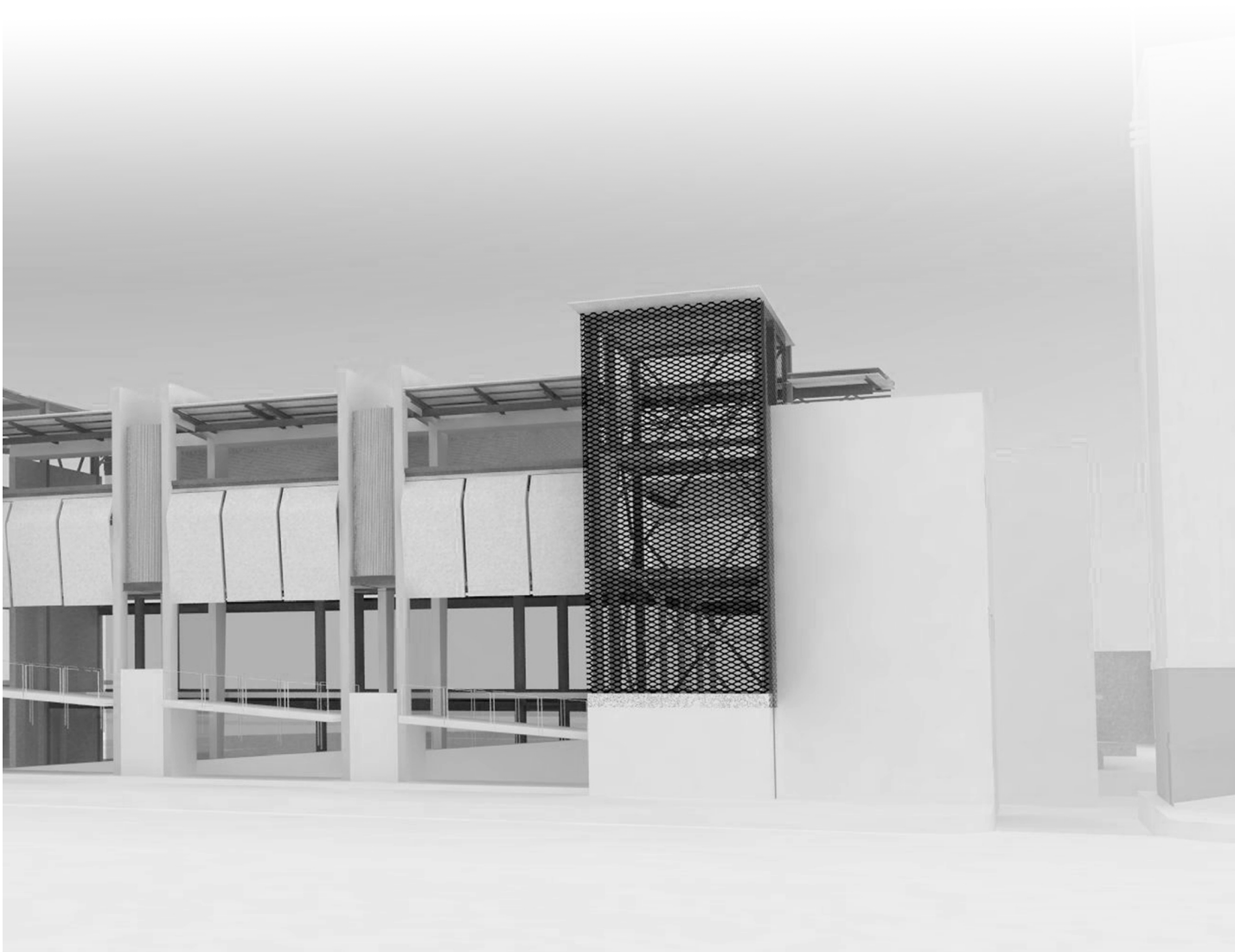






South facade perspective from the recreational landscape





North facade perspective from Stanza Bopape Street

Structural and Tectonic Intentions

Exploded axonometric illustrating the structural and tectonic intentions of the building

Sculpting the landscape through the constructed water channel:

The continuous sculpted landscape, water channel and boundary wall are constructed as a continuous stereotomic concrete platform, creating a continuous translation between the ground and lower boundary wall condition.

The Service and structural core:

The extended structural and service spine as filtration device, supporting the continuous lightweight roof structure, mediates between the stereotomic concrete landscape and the extended steel structure, and is expressed through the change in material application method and resolution of connections. The infrastructural nature and structural integrity of the continuous service spine is expressed through the robust nature and bracing of the structural components.

The internal and external edge conditions as serviced by the structural and service core:

The circulation and public street activities skin / façade is constructed as a tectonic steel frame to express the permeability and rigid organisation of the structure, responding to the public contextual and functional informants.

The internal activities are supported by circular steel members to express the lightness, transparency and permeability of the structure and translate its relationship to the constructed natural landscape through structures and spaces that are adaptable, organic and less restricted by contextual and functional conditions.



Continuous Roof Structure:

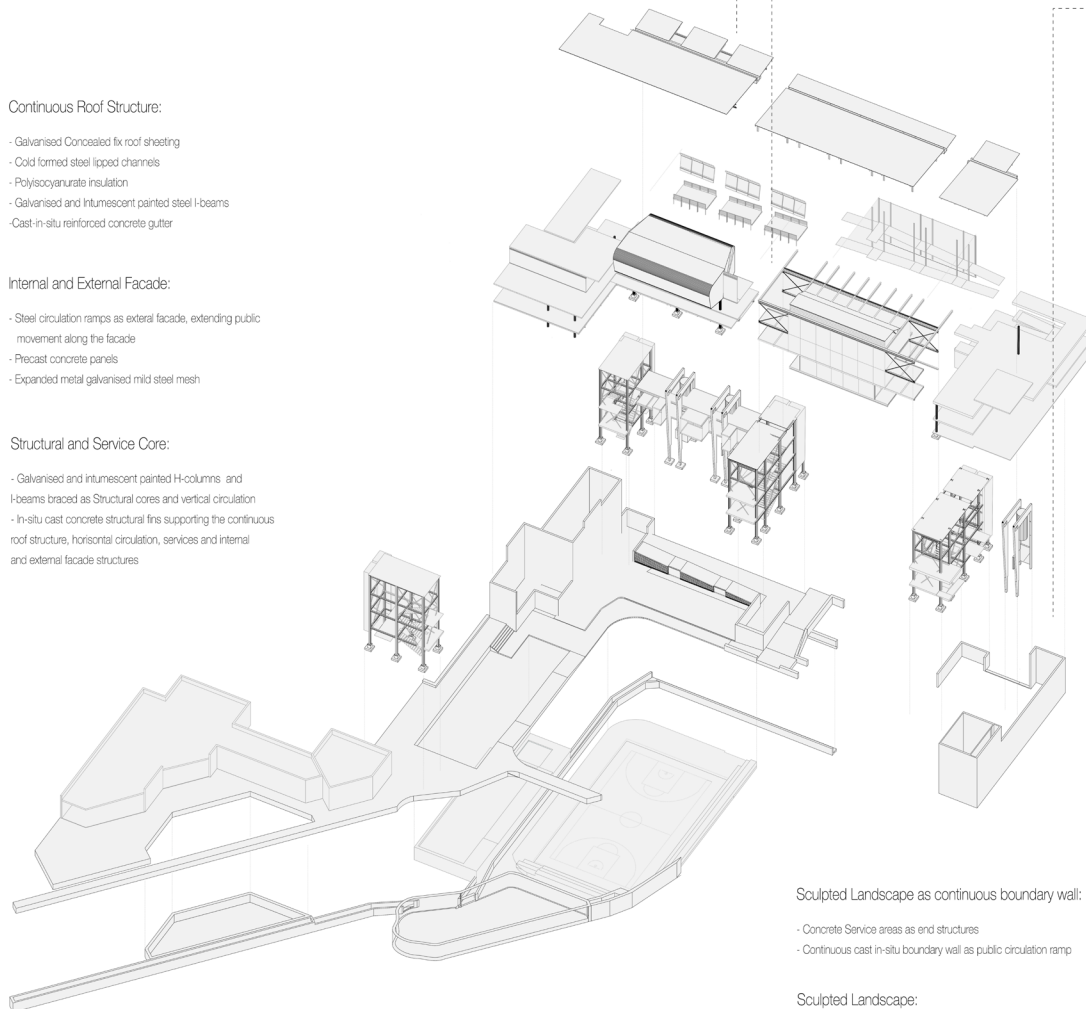
- Galvanised Concealed fix roof sheeting
- Cold formed steel lipped channels
- Polyisocyanurate insulation
- Galvanised and Intumescent painted steel I-beams
- Cast-in-situ reinforced concrete gutter

Internal and External Facade:

- Steel circulation ramps as external facade, extending public movement along the facade
- Precast concrete panels
- Expanded metal galvanised mild steel mesh

Structural and Service Core:

- Galvanised and intumescent painted H-columns and I-beams braced as Structural cores and vertical circulation
- In-situ cast concrete structural fins supporting the continuous roof structure, horizontal circulation, services and internal and external facade structures



Sculpted Landscape as continuous boundary wall:

- Concrete Service areas as end structures
- Continuous cast in-situ boundary wall as public circulation ramp

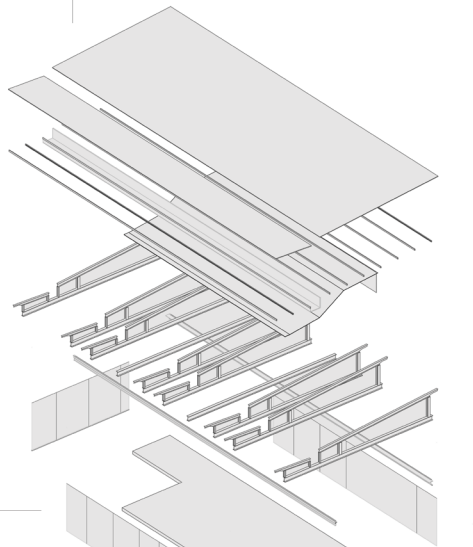
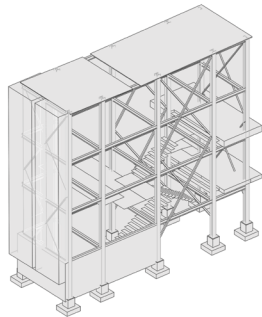
Sculpted Landscape:

- Artificially constructed water channel, wetland and reservoir system
- Concrete public outdoor sports square as detention flooding structure
- Public swimming pool

Development of the exhibition structure spanning the Apies River stormwater Channel

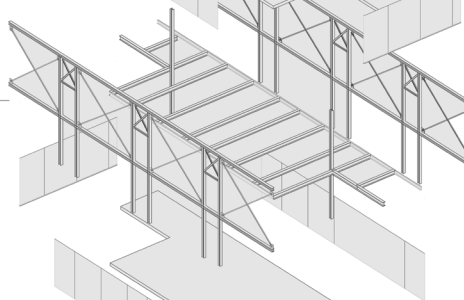
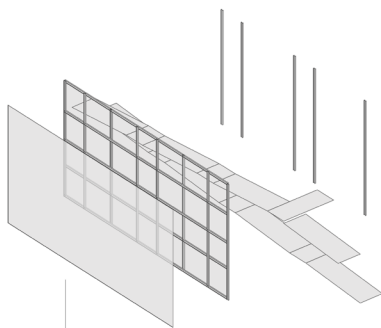
Continuous Roof Structure:

- Galvanised Concealed fix roof sheeting
- Cold formed steel lipped channels
- Seamless Aluminium gutter with neoprene sleeve
- Polyisocyanurate insulation ceiling
- Galvanised and Intumescent painted steel I-beams roof trusses
- Frameless structural double glazing envelope with stainless steel spider clamps, fixed to steel channel as end to floor slab.
- 260mm cast in-situ suspended floor slab between floor I-beams



Wall as beam structure

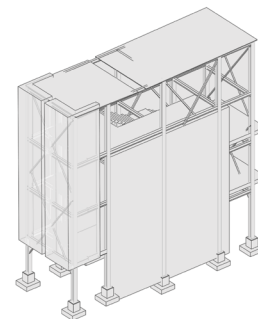
- Galvanised steel I-Sections, H-columns and angle bracing to create custom composite 5000mm deep beam, supporting the roof structure above and first and ground floor suspended structure below.

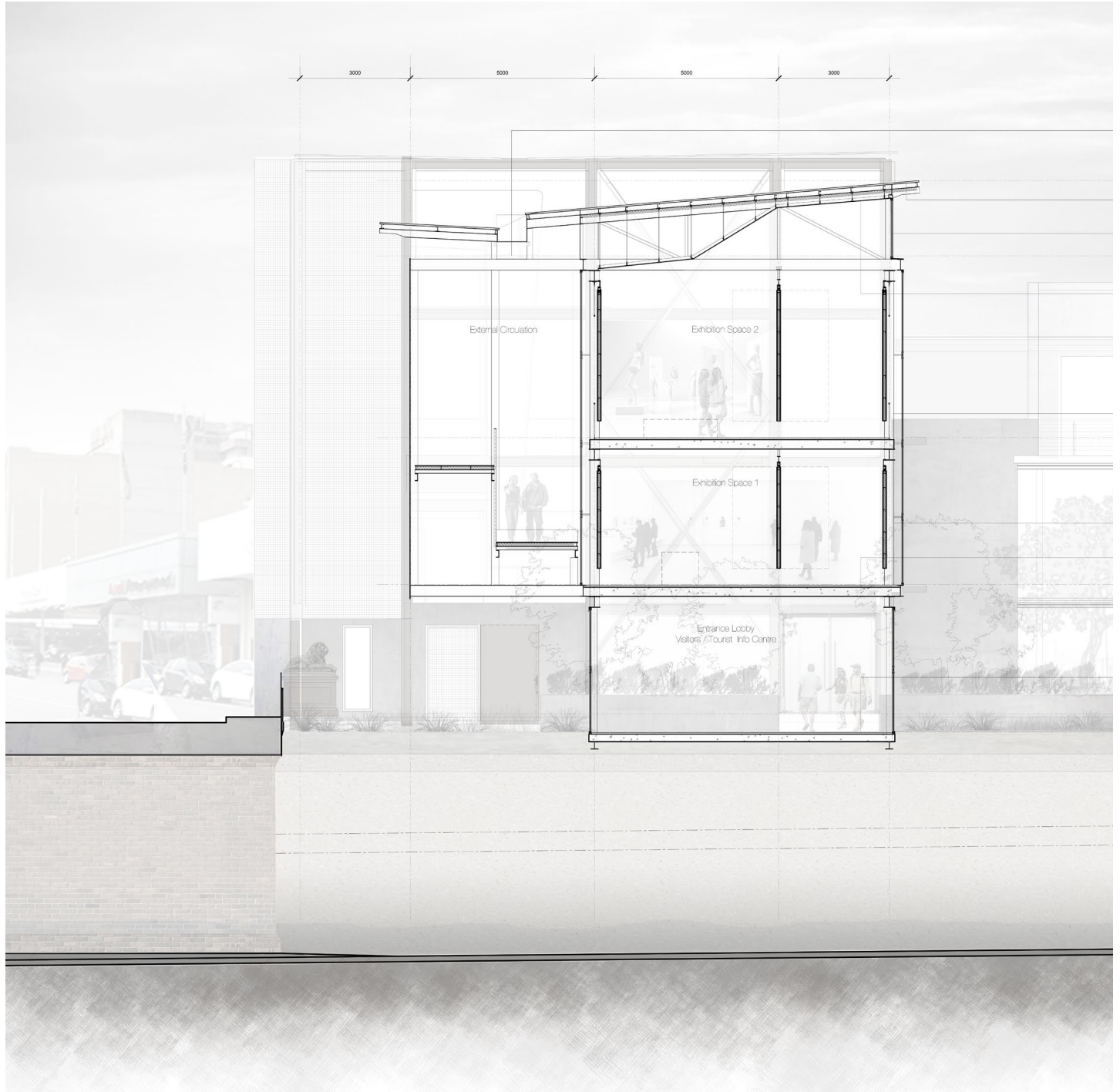


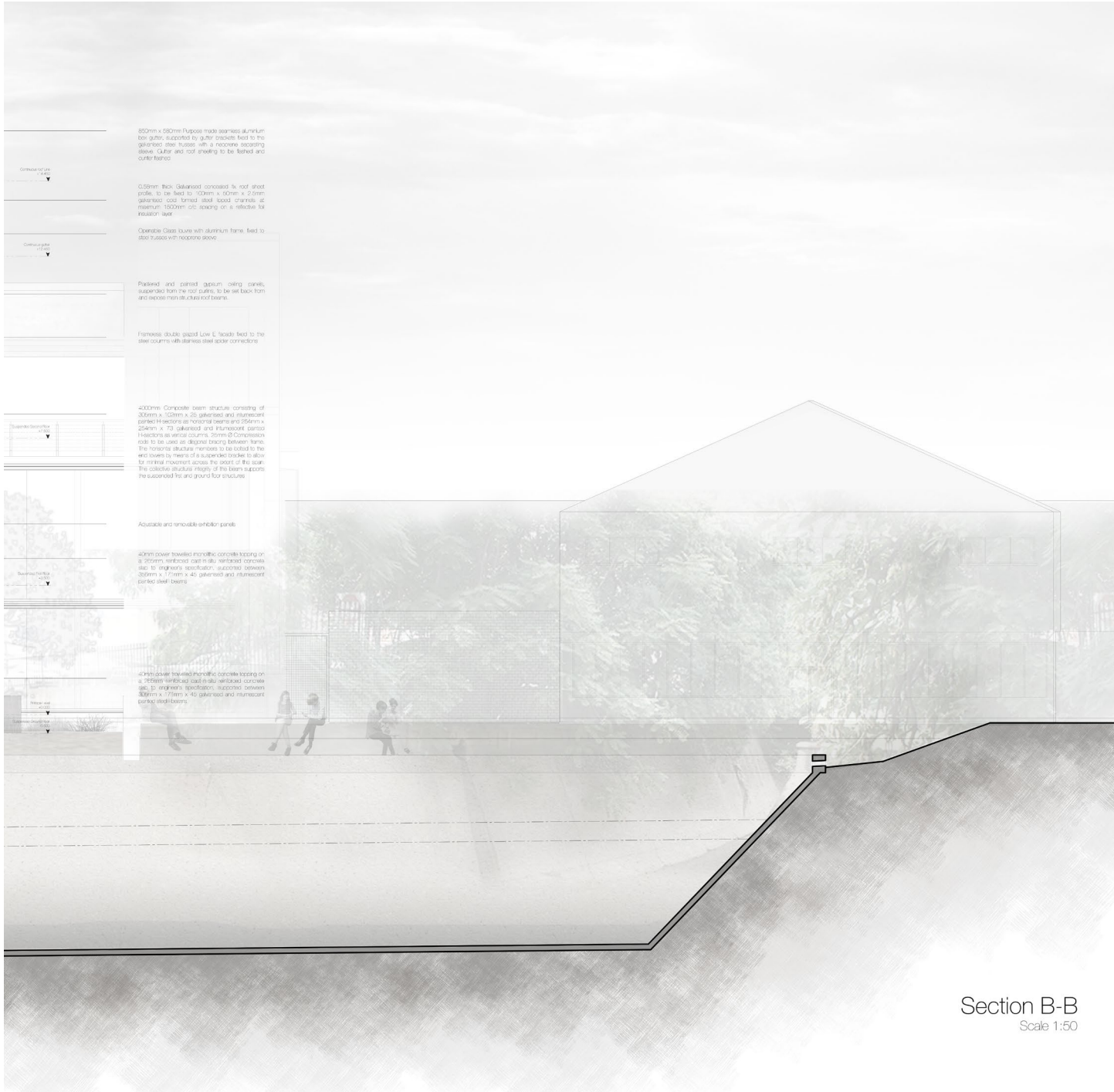
- Galvanised expanded metal mesh
- Galvanised cold-formed steel substructure fixed to galvanised H-columns and I-beams
- Steel circulation ramp fixed to H-columns and I-beams, projecting from the main structure

Suspended entrance lobby

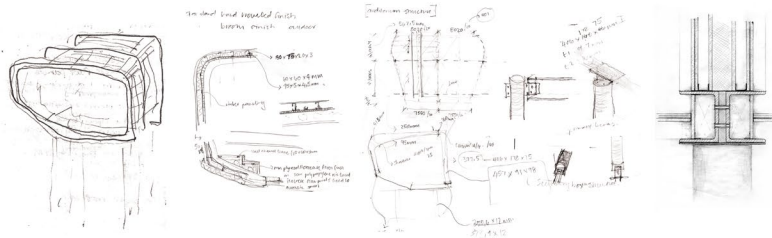
- Concrete cast-in-situ floor slab between steel floor I-beams, suspended from the first floor structure with 114mm Ø circular steel columns.



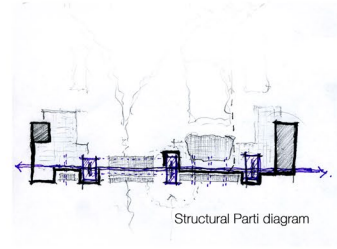




Development of the structural and service spine supporting internal and External Edge Conditions



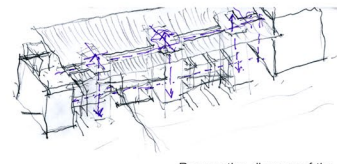
Development of the auditorium structure



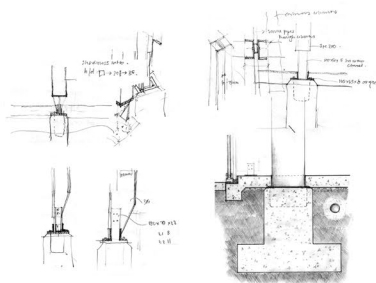
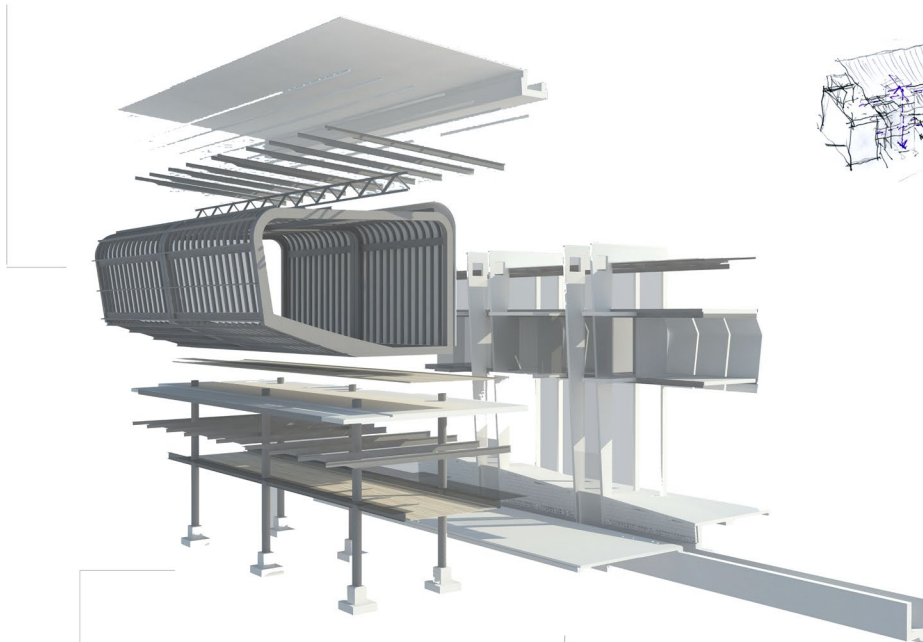
Structural Parti diagram



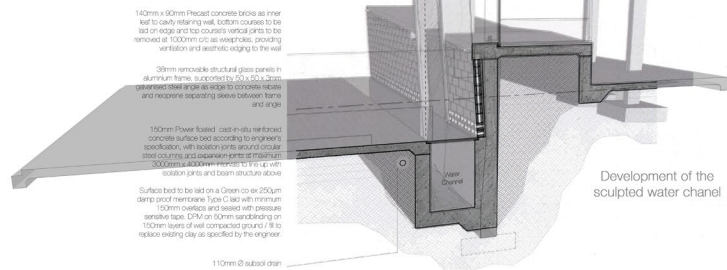
Sectional diagram of structural intention: Continuous Structural and Service Core supporting internal and external edge conditions



Perspective diagram of the structural intentions



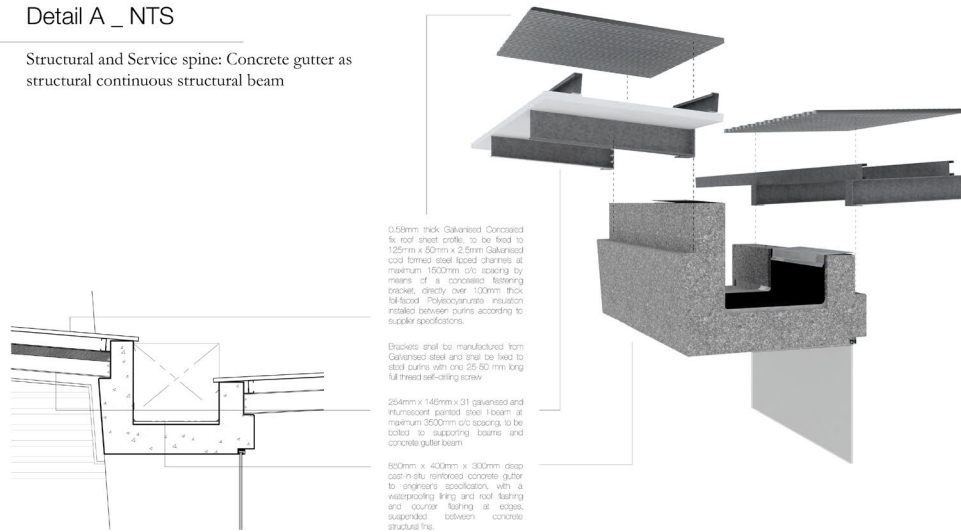
Detail development of the column footings



Development of the sculpted water channel

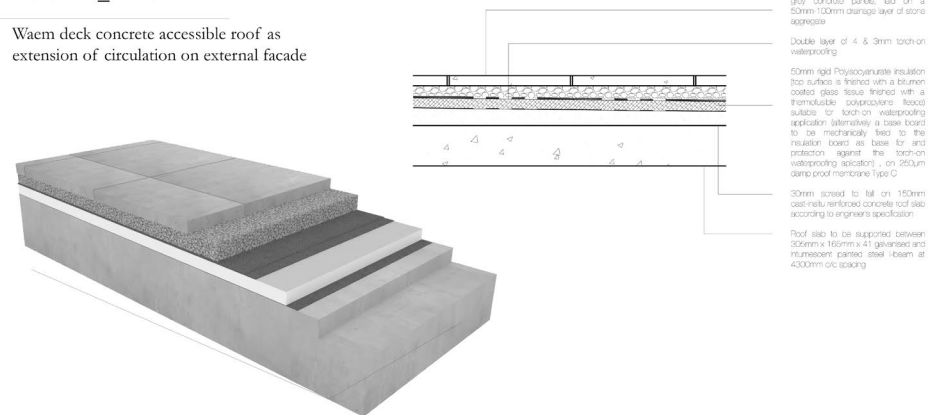
Detail A _ NTS

Structural and Service spine: Concrete gutter as structural continuous structural beam



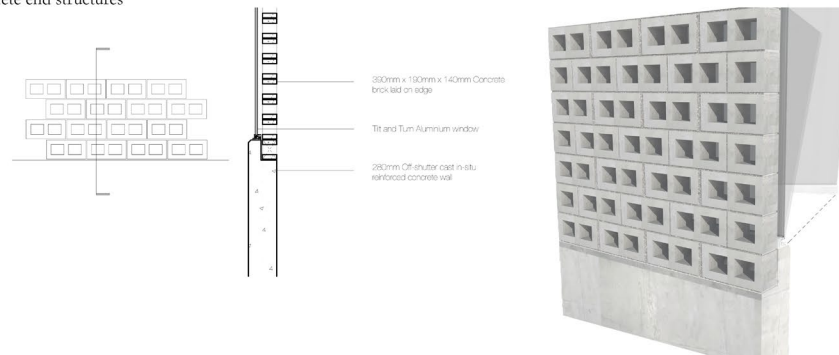
Detail B _ NTS

Waem deck concrete accessible roof as extension of circulation on external facade



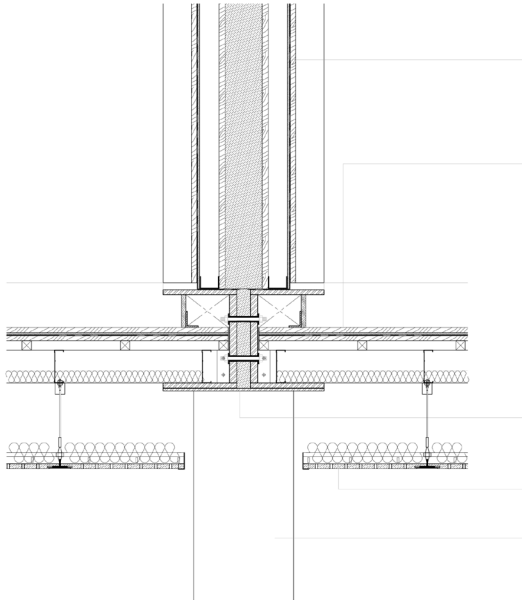
Detail C _ NTS

Service window detail within the concrete end structures



Detail D _ NTS

Column, beam, floor and ceiling connection of auditorium structure expressing acoustic considerations through structure and detail



100mm x 22mm Saligna wall planks, fixed to a 9mm Magnesium Oxide board with rubber acoustic separating layer, bolted to 75mm x 50mm galvanised cold formed channel framework as wall studs, with an internal fibre cement board for added fire resistance, with a 150mm thick Polysocyanurate insulation

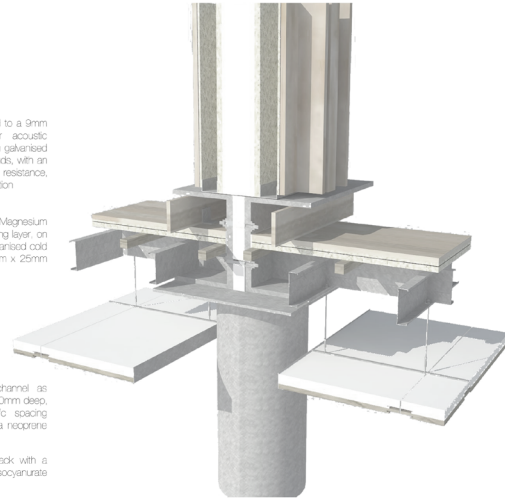
21mm Sealed plywood floor on a 9mm Magnesium Oxide board on a rubber acoustic separating layer, on a 21mm plywood, separated from the galvanised cold formed light steel floor structure with 25mm x 25mm timber acoustic spacers on a rubber sleeve

Continuous custom Galvanised steel channel as primary structure between 350mm and 750mm deep, with 500mm flanges, at 800mm c/c spacing maximum, bolted to the base plate with a neoprene separating sleeve for acoustic purposes

Steel channels to be bolted back to back with a neoprene gasket and 50mm thick Polysocyanurate insulation for acoustic purposes

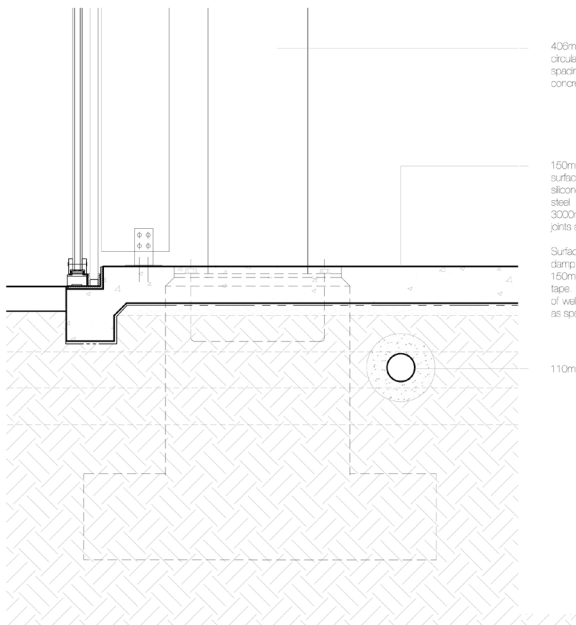
600mm x 600mm x 21mm Suspended timber acoustic ceiling panels, fixed to light gauge steel sections with suspensions rods and T-hanger tie beams at maximum 1200mm x 600mm c/c spacing, with 100mm Polysocyanurate insulation on ceiling panels

406mm x 8mm Galvanised and intumescent painted circular steel columns at 5000mm x 8000mm c/c spacing



Detail E _ NTS

Structural and Service spine: Concrete gutter as structural continuous structural beam

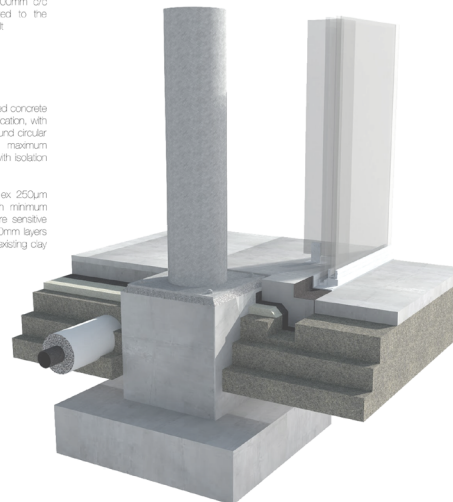


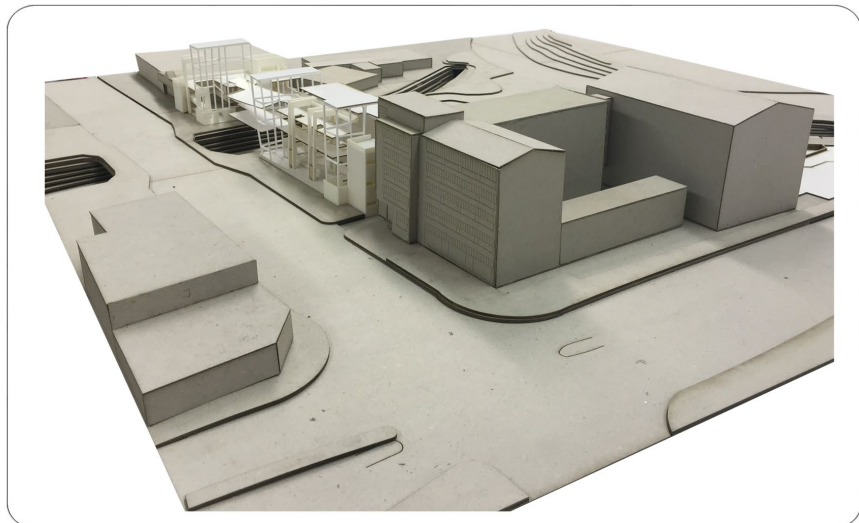
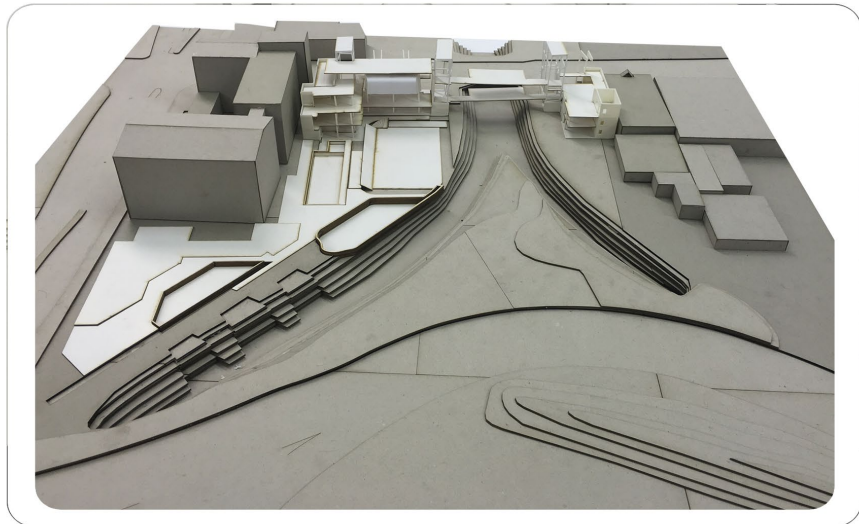
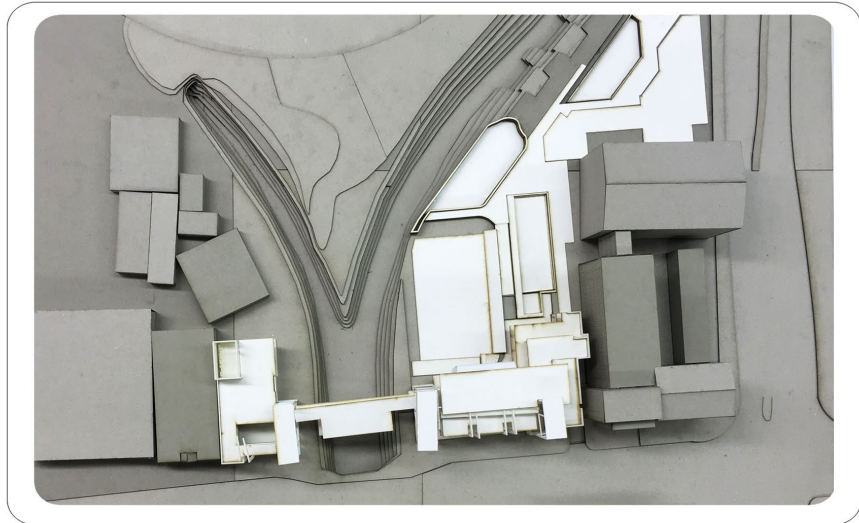
406mm x 8mm Galvanised and intumescent painted circular steel columns at 5000mm x 8000mm c/c spacing, welded to a base plate, bolted to the concrete footing with a hot-rolled steel U-bol

150mm Paver floated cast-in-situ reinforced concrete surface bed according to engineer's specification, with silicone sealed v-joint as isolation joints around circular steel columns and expansion joints at maximum 3000mm x 4000mm intervals to line up with isolation joints and beam structure above

Surface bed to be laid on a Green co ex 250um damp proof membrane Type C laid with minimum 150mm overlaps and sealed with pressure sensitive tape, DPM on 50mm sandblinding on 150mm layers of well compacted ground / fill to replace existing clay as specified by the engineer.

110mm Ø subsoil drain





9.2

Conclusion

It is a law of nature we overlook, that intellectual versatility is the compensation for change, danger, and trouble. An animal perfectly in harmony with its environment is a perfect mechanism. Nature never appeals to intelligence until habit and instinct are useless. There is no intelligence where there is no change and no need of change. Only those animals partake of intelligence that have a huge variety of needs and dangers.

(Wells 2002:47)

The dissertation set out to address the spatially fragmented public realm of the present condition of our cities, resulting from the great divide between nature and culture of the modern paradigm, and from the development of industrialisation and urbanisation that control natural resources in isolated networks of infrastructural systems. Regardless of the multiplication of artificial environments, our cultural influences cannot be removed from our interpretation of nature that establishes us as living beings. Both the cultural constructs and natural entities of cities are manifestations of the relations between natural and cultural developments over time, and collectively influence a city's distinctive existence (Whiston Spirn 2002:4). Infrastructure has the potential to facilitate an integrated continuum of this nature-culture exchange between natural systems and the resources operating in and shaping our artificially constructed built environments.

Through a concentrated investigation of the spatial consequences of the bureaucratic approach to development and infrastructural implementation in the City of Pretoria, the Apies River Corridor and the identified site, a reinterpretation of our development processes is proposed – a reinterpretation that is concerned with the acknowledgment of non-human natural systems and processes as agents in interventions, and that emphasises the constraints of our cultural practices through the construction of an artificial environment that stimulates a symbiotic relationship between our ecological and socio-cultural existences. Such a reinterpretation requires a fundamental change in perspective concerning the demands that necessitate flexible and resilient infrastructure design to meet the more variable conditions of our future cities.

The programmatic response of a decentralised urban stormwater filtration system and cultural memory park with social, economic and recreational facilities, aims to conserve and sustainably reclaim and reuse water, towards establishing an ecosystemic relationship between ecological processes and socio-economic activities, with the architectural intervention as facilitating agent. The proposed recreational and socio-economic appropriations represent possible scenarios for the animated infrastructure, and therefore an alternative reimagination of a hybrid typology is proposed as an extension of the existing infrastructure of the urban realm, Stanza Bopape Street, and the regenerated Apies River Island, that:

- contains and activates the potential of the recreational landscape;
- offers new public spaces through a relationship between Stanza Bopape Street and the river;
- increases the area's ecological contribution through reinscribing an identity for it;
- amplifies its historic and cultural significance through relationship between the proposed interventions and historical remnants surrounding the site;
- capitalises on the spatial, material and socio-economic possibilities of infrastructure; and
- provides an enigmatic experience beyond its infrastructural use.

By reimagining existing infrastructure as part of the production of form and space, through innovative design interventions, alternative occupation, and public appropriation of disenfranchised urban spaces, the spatial, material, and socio-economic potential of infrastructure is exploited towards enhancing the precinct's ecological contribution to and historic significance for the city, and reinstating an enigmatic and recreational experience as well as ecological awareness beyond its infrastructural use.

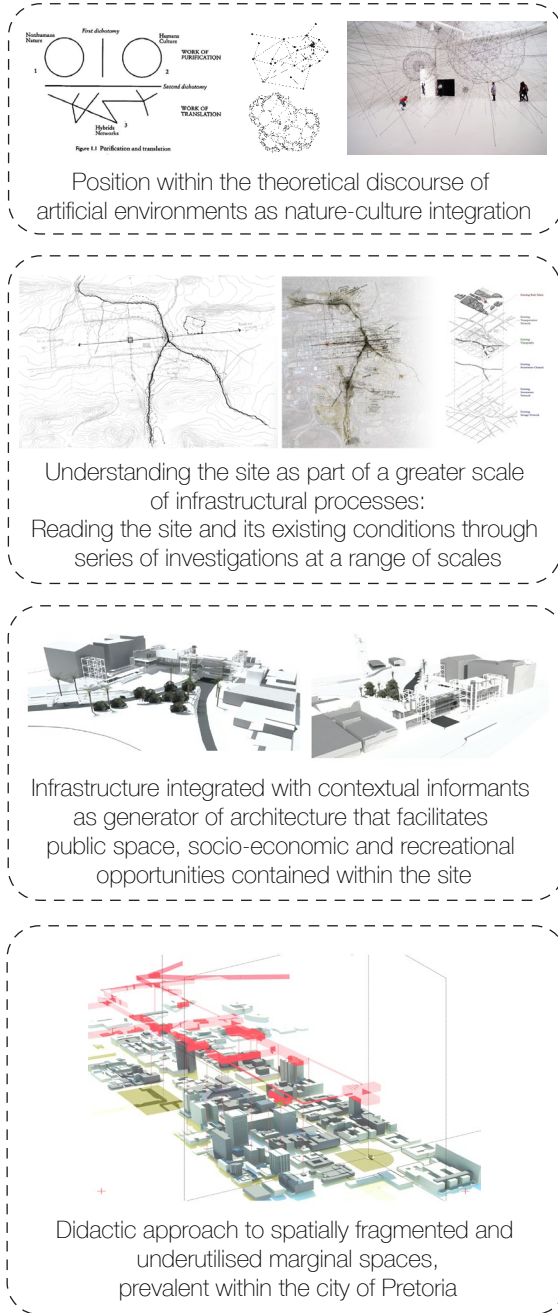


Figure 9.1: Diagramme of approach to project and its contribution to the discourse of Architecture

By reimagining existing infrastructure as part of the production of form and space, through innovative design interventions, alternative occupation, and public appropriation of disenfranchised urban spaces, the spatial, material, and socio-economic potential of infrastructure is exploited towards enhancing the precinct's ecological contribution to and historic significance for the city, and reinstating an enigmatic and recreational experience as well as ecological awareness beyond its infrastructural use.

The "final" proposal and investigation of the project is therefore rooted in a broader spatial vision – from the scale of the site to the scale of the city – that aims to become a didactic metabolism for activating the specific condition and similar consequential conditions prevalent in the City of Tshwane.

Bibliography:

Armitage, N. Vice, M. Fisher-Jeffes, L. Winter, K. Spiegel, A. & Dunstan, J.. 2012. The South African Guidelines for Sustainable Drainage Systems, University of Cape Town: Water Research Commission.

Bacon, F. 1620. *Novum Organum*. Cambridge: Cambridge University Press.

Barnard, B. & van Niekerk, K. 2013. Lion Bridge (over Apies River). [O] Available: [http://able.wiki.up.ac.za/index.php/Lion_Bridge_\(over_Apies_River\)](http://able.wiki.up.ac.za/index.php/Lion_Bridge_(over_Apies_River))
Accessed July 2015.

Carlisle, S. & Pevzner, N. 2013. Introduction: Rethinking Infrastructure, *Scenario Journal*. [Online]. Available: http://scenariojournal.com/article/introduction_rethinking_infrastructure/
Accessed March 2015.

Cengiz, B. 2013. Urban River Landscapes. In: Özyavuz, M. (ed.). *Advances in Landscape Architecture*. Rijeka: Intech, 551-586.

CH2 Melbourne City Council House 2 / DesignInc, 2013 [Online] Available: <http://www.archdaily.com/395131/ch2-melbourne-city-council-house-2-designinc>
Accessed 10 08 2015.

Cheonggyecheon Restoration Project, Seoul, South Korea. 2011. [O] Available: <http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/case-studies/cheonggyecheon-restoration-project>
Accessed 20 July 2015.

City of Cape Town Development Service, Transport, Roads & Stormwater Directorate. 2002. *Stormwater Management Planning and Design Guidelines for New Developments*. Cape Town: City of Cape Town.

Dippenaar, M.A. 2013. *Hydrogeological Heritage Overview: Pretoria's Fountains - Arteries of Life*. Pretoria: Water Research Commission.

Ecofriendly architecture, global green buildings saving the earth, 2014 [Online] Available: <http://www.samsungcntblog.com/2014/05/ecofriendly-architecture-global-green-buildings-saving-the-earth/>
[Accessed 10 08 2015].

Fabrizi, M., 2014. *Inhabiting Infrastructures: Indian Stepwells*. [Online] Available: <http://socks-studio.com/2014/03/13/inhabiting-infrastructures-indian-stepwells/>
[Accessed May 2015].

Farris, T., 2009. *Cartier Foundation, Jean Nouvel*. [Online] Available: <https://www.flickr.com/photos/travelsofmine/3817621115>
[Accessed 10 09 2015].

Galinski, A., 2011. "Fondation Cartier" Museum for contemporary Art. [Online] Available: <http://architecture.mapolismagazin.com/ateliers-jean-nouvel-fondation-cartier-museum-contemporary-art-paris>
[Accessed 10 09 2015].

Gans, D. 2004. The Sky above and the Ground Below Emscher. *Architectural Design*. 74(2): 50-53.

Grey, W. 2009. Last Man Arguments. *The Encyclopedia of Environmental Ethics and Philosophy*. 2: 40-41.

Hagan, S. 2001. *Taking Shape: A new contract between architecture and nature*. 1st ed. Oxford: Architectural Press.

Hilton, T. n.d. Flickr. [O] Available:
<https://www.flickr.com/photos/hilton-t/10558755965>
Accessed July 2015.

Holl, S. 1996. Pamphlet Architecture 13: Edge of a City. New York: Princeton Architectural Press.

Huffman, P.T.N. 2010. South African History Online, Prehistory of Pretoria. [O] Available:
<http://www.sahistory.org.za/topic/prehistory-pretoria>
Accessed June 2015.

Hwang, N. & Moon, D. E. 2011. NHDM LINES X CITIES 1 : Urban Highways. [O] Available:
<http://www.nhdm.net/lines-x-cities2/topic-abstract-spring-2011/16338350>
Accessed July 2015.

International Council on Monuments and Sites. 2013. The Burra Charter: The Australia ICOMOS charter for places of cultural significance. [O] Available:
<http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>
Accessed July 2015.

Janssen, A. 2011. Die Leebrug. Pretoria, University of Pretoria.

Januchta-Szostak, A. 2012. Urban Water Ecosystem Services. Sustainable Development Applications, 3, 91-109.

Jones, O. 2009. Nature-Culture. International Encyclopedia of Human Geography. 7: 309-323.

Kaltenbach, F., 2014. From Schaustelle back to the site. [Online] Available:
<http://www.detail.de/artikel/von-der-schaustelle-zurueck-auf-die-baustelle-11692/>
[Accessed 10 09 2015].

Koolhaas, R. 1994. The Generic City. In: S, M, L, XL. Koolhaas, R. & Mau, B. eds. New York: Monacelli Press, 1238-1264.

Latour, B. 1993. We Have Never Been Modern. Cambridge: Harvard University Press.

Latour, B. 2008. A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). Cornwall, Design History Society Falmouth.

Lecomte, J. 2013. Beyond indefinite extension: about Bruno Latour and urban space. Social Anthropology 21: 462-478.

Livingston, M., 2002. Steps to Water: The Ancient Stepwells of India. New York: Princeton Architectural Press.

Los Angeles River Revitalization Master Plan, Los Angeles, CA. 2009. [Online] Available:
<http://www.asla.org/2009awards/064.html>
Accessed 11 August 2015.

Mador, M.L. 2008. Water, Biophilic Design and the Built Environment. In: Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life, edited by Kellert, S.R., Heerwagen, J. & Mador, M. New Jersey: Wiley, 43-57.

Manore, J. 2006. Rivers as Text: From Pre-Modern to Post-Modern Understandings of Development, Technology and the Environment in Canada and Abroad, in A History of Water: The World of Water, edited by T. O. Terje Tvedt. London: I.B. Tauris: 229-253.

Meinhold, B. 2010. Seoul Transforms a Freeway Into A River and Public Park. [O] Available:
<http://inhabitat.com/seoul-recovers-a-lost-stream-transforms-it-into-an-urban-park/2/>
Accessed 21 July 2015.

- Meyboom, A. 2009. Infrastructure as Practice. *Journal of Architectural Education*, 72-81.
- Morphopedia, 101 Pedestrian Bridge, 2009 [Online] Available:
<http://morphopedia.com/projects/101-pedestrian-bridge>
[Accessed June 2015].
- Natoli, S. 1992. Human Beings. Between the natural and the artificial, in *Life between Artifact and Nature: Design and the Environmental Challenge*. Milan: Mondadori Electa: 102-106.
- Nuttall, S. & Mbembe, A. 2007. Afropolis: From Johannesburg. *PMLA*, 122(1): 281-288.
- Seewang, L. 2013. Skeleton Forms: The Architecture Of Infrastructure. [Online]. Available:
<http://scenariojournal.com/article/skeletonformsthearchitectureofinfrastructure/>
Accessed 10 May 2015.
- Schaustelle / J. Mayer H. Architects, 2013 [Online] Available:
<http://www.archdaily.com/420787/schaustelle-j-mayer-h-architects>
[Accessed June 2015].
- S.n. Ken Yeang: Ecomasterplanning. 2009. *Architecture Today*, 20, 12.
- S.n. Los Angeles River Revitalization Master Plan, Los Angeles, CA. 2009. [O] Available:
<http://www.asla.org/2009awards/064.html>
Accessed 11 August 2015.
- South Africa History Online. 2015. Pretoria Timeline 1800-2009. [O] Available:
<http://www.sahistory.org.za/topic/pretoria-timeline-1800-2009?page=1>
Accessed July 2015.
- Stairs, D. 2010. Biophilia and Technophilia: examining the nature/culture split in design theory, in *The Designed World: Images, Objects, Environments*, edited by R. Buchanan, D. P. Doordan & V. Margolin. Oxford: Berg Publishers: 339-345.
- Sveiven, M., 2010. AD Classics: Fondation Cartier / Jean Nouvel. [Online] Available:
<http://www.archdaily.com/84666/ad-classics-fondation-cartier-jean-nouvel>
[Accessed June 2015].
- Treib, M. 2009. *Spatial Recall*. New York: Routledge.
- Whiston Spirn, A. 2002. *The City as a Garden : Urban Nature and City Design*. Illume.
- Woods, L. 2009. Lebbeus Woods: Storm Watch. [Online] Available:
<https://lebbeuswoods.wordpress.com/2009/12/19/storm-watch/>
Accessed March 2015.
- Worster, D. 1985. *Rivers of Empire: Water, aridity and the growth of the American West*. Illustrated, reprinted ed. Oxford: Oxford University Press.
- Wuppertal Institut für Klima, 2013. *Emscher 3.0, From grey to blue*, Bonen: Wuppertal Institut für Klima.

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