TŪHONONGA.

Architecture Co-occupying with Earth and Sky

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I te Tīmatanga

I te tīmatanga ko TE KORE - in the beginning there was TE KORE, a void of nothingness at the beginning of time and space. The void in which nothing is felt, the void with nothing is in union, the space without boundaries, where there were no relative elements to measure, no sun to define day from night, no turning of the tide and no resemblance of life or death. TE KORE passed through many stages, each phase giving birth to the next until TE KORE became TE PŌ, the time and space of impenetrable darkness.

The inception periods of TE KORE and TE PŌ birthed the metaphysical elements, bringing forth the unity of Ranginui, sky father and Papatūānuku, earth mother. From their loving embrace came the birth of their offspring, the godsons – ATUA MĀORI, each with attributes unique to their own. However, the sons' upbringing was not pleasant, living in the realm between the tight embrace of their parents Rangi and Papa, a realm within TE PŌ that was not big enough for the sons to stand. Space itself was crowded, complete darkness, no knowing of what's on the horizon nor what is above or below you. Over time, some of the children became distraught with such living conditions and grew a consciousness and belief that there must be more beyond their parents embrace.

The sons gathered to discuss what should be done, noted as the first instance of wānanga. Deliberating their living conditions, Tūmatauenga, god of war and man, proposed the option of exterminating their parents. Conversely, Tawhirimātea, god of the winds and weather, wanted no action to be done as they were protected with shelter and warmth. Debate was heard and after time, a final proposition was brough forth. Tāne-Mahuta, god of the forest, with support from Tangaroa, god of water and the ocean, and Rongomatāne, god of cultivated food and peace, proposed a compromise to separate the two so that one lives high above and the other below, thus creating a space to live but with no restrictions.

The proposal was accepted and the attempts to separate Rangi and Papa began. Rongomatāne attempted, with his feet planted to the ground, pushing up with his arms, but failed. Tangaroa followed and failed; another brother Haumia-tiketike, god of uncultivated foods, attempted but also failed. Then came Tūmatauenga, enraged with with anger after losing during deliberations, attempted with a heavy heart and failed like his brothers before him. With Rūaumoko still within the womb of their mother, Tāne was the last brother to remain. Tāne took a different approach, laying his head and shoulders on Papa, and placing his feet above against Rangi. Tāne started to swell and shift, which saw him well up, crouched tight together, then finally using his feet he thrust his legs, propelling Rangi up and pushing Papa below, bringing the present existence TE AO MARAMA, TE AO TŪROA and the enduring natural world of light we know today.

Figure – 1 Te Korekore (2021), Mixed Media

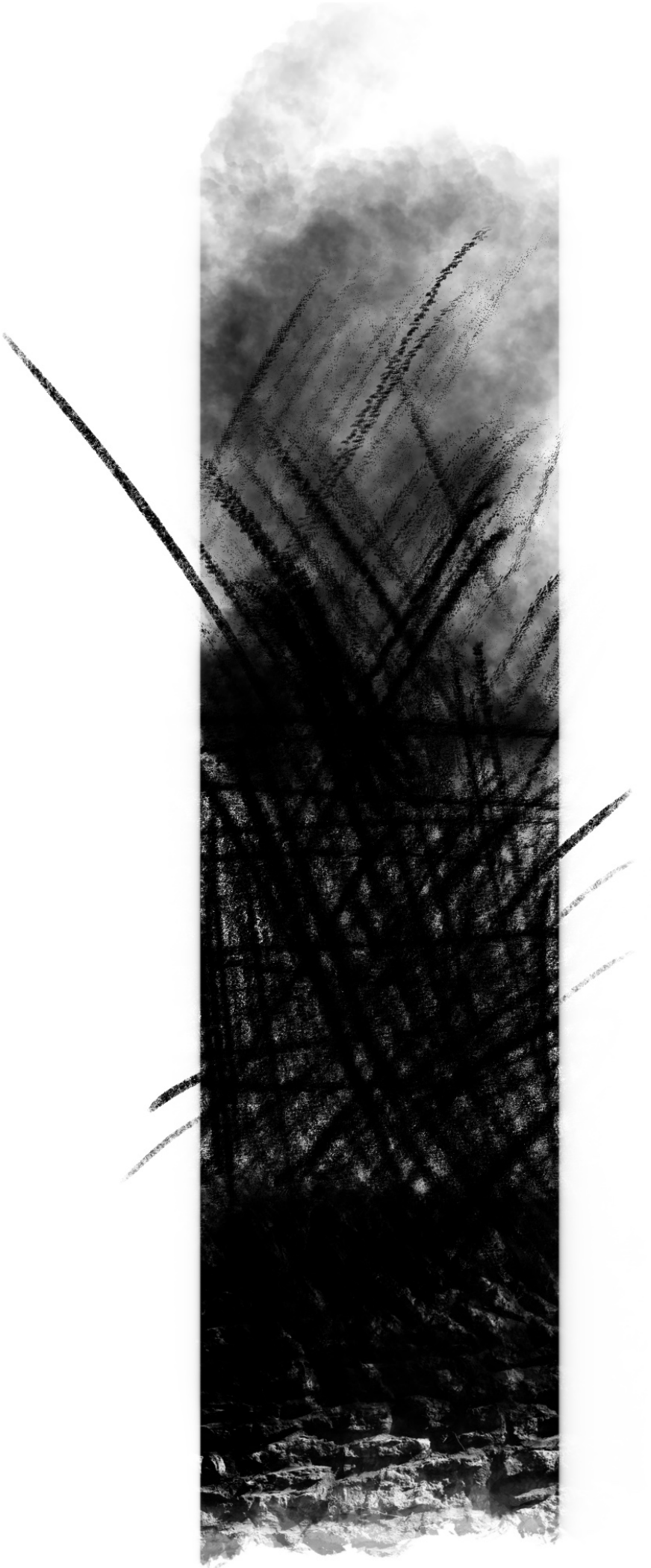


Figure - 2 Muruika Urupa, Digital Photograph

Pepeha

E noho ana au i tōku taumata whakamarumaru o Ngōngōtahā
Taka rawa iho ngā wai o Utuhina, e piri nei ki te taha o Pukeroa Oruawhata.
Ka huri te titiro ki Tiheia, e aru korikoriko ana ngā wai o Awahou,
E ai rā te titiro ki nga wai karekare i a Rotorua-nui-a-Kahu.
Ka whakawhiti atu ki te maunga taua o Matawhau,
Ka titiro whakararo ki te moana nui o Te Rotoiti-i-kite-ai-e-Ihenga.
Tēnei ko ngā taumata me ngā wai o taku whakatupuranga, nō roto mai i te rohe o Te Arawa,
I waenga i ngā uri o Ngā Pūmanawa e Waru.
Koia tēnei he uri nō ngā tātai whakapapa maha o taku tupuna a Rangitihi-Upoko-Whakahirahira-i-Takaea-ki-te-Akatea.
Ka huri te titiro ki Tarawea,
Takahia rā ki ngā wai o Taupō-Nui-a-Tia, ki ngā wai tukukiri Rangātira o Tūwharetoa.
Tū mai rā te maunga titohea nei a Tongariro.
Hoki rawa mai ki au, ki Rotorua.
Whakawhiti atu ki ngā wai o Waioweka, e rere iho ki ngā Waihirere o Te Tai Rawhiti, ki te nohoanga o taku kuia, ki ngā uri o Te Aitanga-a-Mahaki me Rongowhakaata.
Hoki rawa mai ki au, ki Te Arawa, ki Rotorua, taku tūrangawaewae.
Tihei mauri ora.

Abstract

TŪHONONGA is a design-based research proposal exploring indigenous Māori narratives to help understand how we can better co-occupy with more-than-human entities like maunga, wai, Rangi and whenua. Designing a long-term vertical papakāinga that is themed with such notions is the objective of this research, while delving into how Te ao Māori practice explored through narratives can create architecture that highlights our surrounding environmental entities while also re-imaging how we can co-exist on earth between Ranginui and Papatūānuku. This concept of thinking challenges the current westernised state of living by questioning our actions as humans on this earth, as the ever-present ecological crisis worsens by the day.

This exegesis weaves itself in and out of the themes of TE KORE, to acknowledge traditional indigenous forms of exchanging knowledge and history told through story telling. The narrative grounds the thesis in an authentic Māori position, bringing a form of spirituality to the text, while also developing a personal design approach.

The significance of the project is how it translates the notions of co-occupancy with the more-than-human and Te ao Māori practices into the field of design. It demonstrates how design practice can approach relationships of the physical and the metaphysical to gain understanding as to the potential of co-occupancy within future environments. Doing this through the development of co-occupancy as a methodology framework, uses the notions as settings for design process and analysis, revealing the importance of relationship and consciousness of our actions and decisions in relationality to site and environment.

Figure – 3 Pa Tu (2021), Digital Render

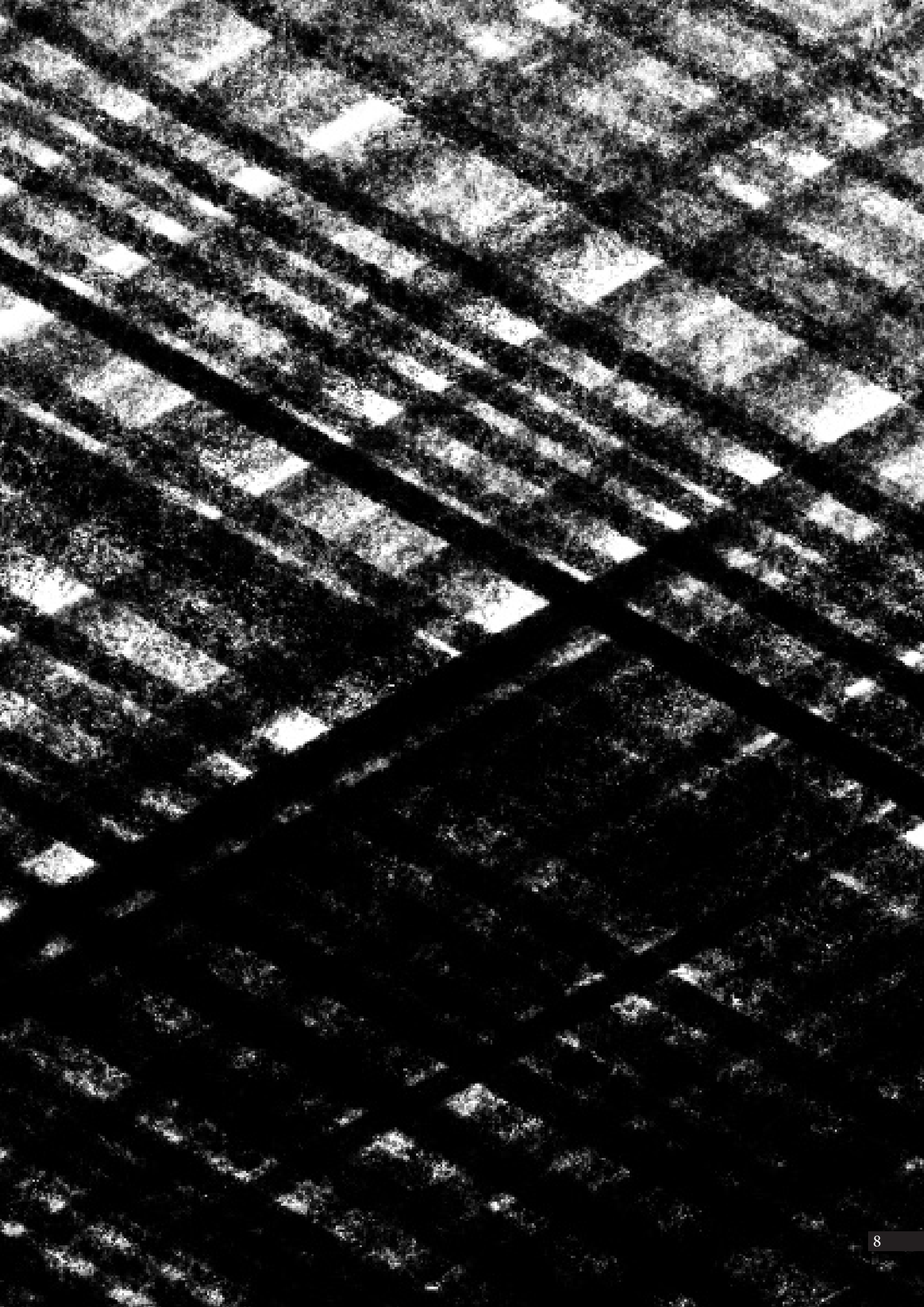
“Whatungarongaro te tangata, toitū te whenua.”
“As man disappears the land remains.”

Co-occupancy

What is co-occupancy? Co-occupancy stems from the use of the verb occupy, to fill, exist in, or use a place in time or period (Dictionary, 1989). According to the WordSense Dictionary (2021), to co-occupy is to occupy place with another (WordSense Dictionary, 2021). In this exegesis another can be physical, intangible or spiritual. Co-living with more-than-human entities and inhabitants from the micro and macro scales of life are the foundational aspirations of this research.

From a Māori perspective, to fully occupy a place is being able to connect with your surroundings. Pepeha is a form in which this is done, a unique way one introduces themselves in Māori. It tells someone who they are by sharing their connections with people and environmental landmarks that are important to them and their people such as mountains and rivers. This in turn symbolises where Māori originate from, through their connection to their environment, to Papatūānuku. To co-occupy can also be more than co-habiting space in the present but also how we co-occupy in the future. What that journey and relationship looks like is what this exegesis will further explore.

Figure – 4 Tuinui (2021), Mixed Media



He Puna Kāinga Ora

Thesis Scope

He Puna Kāinga-Ora Housing & Urban Wellbeing Lab is an initiative of He Puna Wai-Papa-Ora, the Urban Wellbeing Activation Lab at Huri Te Ao, the AUT School of Future Environments.

He Puna Kāinga-Ora postgraduate lab aims to explore and test transformational architectures for holistic wellbeing. The focus of the lab is housing, also working both individually and collectively to advance a shared research focus on holistic socio-cultural-ecological wellbeing at housing and neighbourhood scales. The lab's focus is situated in Rotorua, with key partners Ngāti Whakaue and Te Tatau o Te Arawa, an iwi-led Council-partnered governance group. The mandate of Te Tatau o Te Arawa is to forward a vision for sustainable wellbeing of people, culture, and place with Te Rohe o Te Arawa (Arawa region). The lab also aligns with a National Science Challenge research urban wellbeing programme, a collaboration between AUT and the University of Canterbury.

Figure – 5 Wellbeing Compass

TE TATAU O TE ARAWA HOUSING DEVELOPMENT WELLBEING COMPASS

A TRANSFORMATION TOOL FOR MAURI ORA HOLISTIC WELLBEING

KĀINGA
- Zero-carbon energy generation & storage
- Energy efficiency
- Low embodied carbon materials
- Indoor moisture control
- Compact development
- Papakāinga
- Co-housing
- Biophilia
- Green roof
- Green space
- Kaumatua housing
- Iwi specific

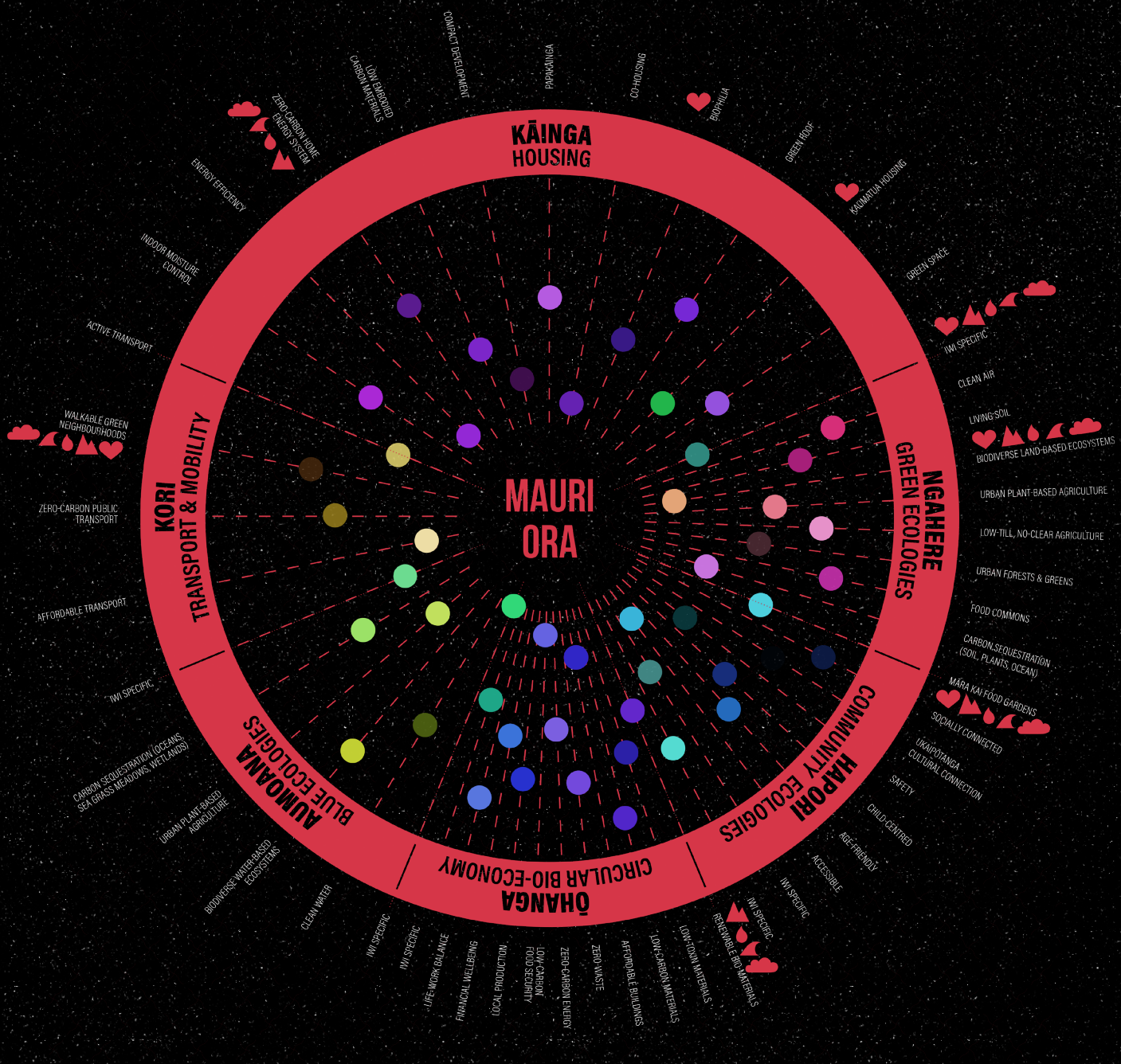
NGAHERE
- Clean air
- Living soil
- Biodiverse land-based ecosystems
- Urban plant-based agriculture
- Low-till, no-clear agriculture
- Urban forests & greens
- Food commons
- Carbon sequestration (soil, plants, ocean)
- Māra kai food gardens

HAPORI
- Socially connected
- Ukaipōtanga - cultural connection
- Safety
- Child-centred
- Age-friendly
- Accessible
- Iwi specific
- Iwi specific

ŌHANGA
- Renewable bio-materials
- Low-toxin materials
- Low-carbon materials
- Affordable buildings
- Zero-waste
- Zero-carbon energy
- Low-carbon food security
- Water security
- Local production
- Financial wellbeing
- Life-work balance
- Iwi specific

AUMOANA
- Clean water
- Biodiverse water-based ecosystems
- Urban plant-based agriculture
- Carbon sequestration (oceans, sea grass meadows, wetlands)
- Iwi specific

KORI
- Walkable green neighbourhoods
- Active transport
- Zero-carbon public transport
- Affordable transport
- Iwi specific



PLANETARY WELLBEING BOUNDARIES:

RANGINUI
Atmosphere wellbeing: clean air (carbon, GHG, ozone balanced, zero-micro plastics) cool climate-functional carbon cycle

HINEMOANA
Ocean ecosystem wellbeing: biodiverse, clean (balanced Nitrogen/Phosphorus cycle; zero-micro plastics), cool (non-acidic, oxygenated), functional carbon cycle

PARAWHENUAMEA
Freshwater ecosystem wellbeing ; biodiverse, clean (balanced Nitrogen/Phosphorus cycle; zero-micro plastics), functional water cycle

PAPATŪĀNUKU
Land-based ecosystem wellbeing: biodiverse (including soil-based carbon sequestering micro living micro soil), clean (toxin & pollutant free with a balanced Nitrogen/Phosphorus cycle), functional carbon cycle

TANGATA
Human wellbeing: human wellbeing from social, cultural and/or ecological connection (Good and equitable subjective wellbeing, physical & mental health, and access to green space, affordable housing, good food, sufficient clean energy, water, transport)

ORA
AN URBAN WELLBEING ACTIVATION LAB

Contents

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of auniversity or other institution of higher learning.

Introduction

Co-occupancy & Culture

Human violence towards our climate has sent Papatūānuku into a state of rage. We are currently living in the Anthropocene where ecological crisis is more present than ever before. The Anthropocene epoch is an unofficial period where our human actions are having a significant effect on our eco-system (Lewis & Maslin, 2015). Our taiao, climate, is irreversibly changing for the worst - our oceans are warming, plastic pollution is circling the globe, air pollution is threatening our very existence and mass extinctions are becoming a reality.

We are now in a time where ecological balance is disrupted. What does this mean for architecture? Becoming more aware of our actions into the future and in the face of ecological crisis, globally and locally, urges the need for co-occupancy with our more-than-human kin.

"The gifts of the earth are to be shared, but gifts are not limitless. The generosity of the earth is not an invitation to take it all. Every bowl has a bottom. When it's empty, it's empty. And there is but one spoon, the same size for everyone" (Wall Kimmerer, 2013, p, 382)

The idea of co-occupying orders this exegesis to delve into how our future living environments can encourage the integration of humans and our wide eco-system. This research looks to architecture to challenge our current Anthropocene state by engaging with Te Ao Māori and delving into Māori world views for answers into how we can be better co-occupants with our wider inhabitants. The research undertaken within this exegesis is interacting with a theoretical project in developing a papakāinga approach for Ngāti Whakaue on the east side of Rotorua in response to their development aspirations on their Wharenui farm land.

Te Ao Māori worldviews have a deep spiritual connection to whenua, especially when considering death in Māori culture. Māori see life and death as a cycle, an acknowledgement of the two existences being inevitable to each other. (Nikora et al., 2010). When Māori die, they are returned to the whenua, the womb of the Papatūānuku with the understanding that life began in the womb and as spiritual beings they venture on their final journey through key landmarks before joining Te Ao Wairua, the spiritual realm (Nikora et al., 2013). Tangihanga provides the space to mourn the reality of the death

staying with them, singing and talking to deceased until the moment they're returned to Papatūānuku (Wihongi, 2013). Whenua thus acts as the place of rest, identity and the connection to our physical and spiritual environments.

TŪHONONGA is focused on unpacking co-occupancy through indigenous knowledge and considering how architects can design our living environments to engage with the ecological and socio-cultural systems. This feeds into the design of a vertical papakāinga that can co-occupy with wider living systems existing between Ranginui and Papatūānuku. Firstly, the research will bring attention to the Anthropocene and ecological collapse that is happening in the world. Next, it will delve into how we can address a design approach towards climate change through spatial design and architecture by working with indigenous knowledge and theoretical analyses to unpack co-occupancy, and provide answers to how we can co-inhabit with our environment and wider inhabitants. Unpacking what co-occupancy is and what it can be, alongside a force-fronting of indigenous knowledge will provide a framework for the actions and methods that will be used as precedence as the design approach for papakāinga.

Te Kore

Chapter One

TE KORE within Māori mythologies is the beginning of time, the void of nothingness, a moment in time with endless possibilities, boundless, free from form. Like TE KORE, this chapter acts as the point of the beginning, boundless and free of form. Thus, it introduces the scope that this exegesis attempts to reach, providing the fundamental foundation of how this research positions itself within the thread of culture and nature. This chapter brings together the current ecological crisis with the support of the ICC Reports to give the exegesis a foundation that is aware of our climate and to bring real life consequences to this theoretical research. Actions we could do as human beings to advert the ever-growing climate change are then introduced, such as the replanting of native bush, adapting new habits of co-living, and acknowledging the importance of indigenous knowledge. Māori perspectives of life and living will be woven through this section, exploring how Māori knowledge can hold secrets to how we might co-occupy our surroundings with all species, micro and macro.

Figure – 6 Te Kore (2021), Mixed Media

Anthropocene

According to the Intergovernmental Panel on Climate Change (IPCC) and their current summary report (2018), human activities have caused approximately 1.0°C of global warming which is 0.5°C above pre-industrial levels, and still rising. This interference with our climate systems poses a threat to humans and natural systems (IPCC,2018). This catastrophic indication puts us as human-beings in an uncomfortable position and our actions and decisions are more important than ever before. Our way of life as we know it is currently not sustainable for our environment that surrounds us, binds us, and gives us life. Without it, we are nothing but mere dust in the wind.
A perfect Māori proverb relating to this state,

"Whatungarongaro te tangata, toitū te whenua - As man disappears, the land remains."

This rings true to the fact that we are at the mercy of Papatūānuku, and indeed will perish without her. In saying that, as big of a task it might seem, recorrecting our current position here in the world to that of a co-existent way of life will be more beneficial for the future. Recorrecting our position in place first can ignite changes to our perspective on our interaction with our environment. This brief precis about the Anthropocene and climate change sets a base for this research as to how it works with the notions of time and place in relation to the future and our living environment and community life.

"Toi tū te whenua, toi tū te tangata - Productive land, prosperous people"

Alongside shifting our mental paradox to co-existing with our environment, there can also be simple actions we as a human race can adopt to support our climate and advert global ecological collapse while thinking about our future environments. The following examples are gestures that this exegesis realises as important actions to advert the ecological collapse

Figure – 7 Encasing Darkness, Digital Photograph

Planting natives

Planting trees is one of the few recommended actions countries can do to help fight climate change. (Bäckstrand & Lövbrand, 2006) The positive impact trees have on our climate by supporting it through cleansing and cooling our air is one aspect to the importance of trees. Trees also provide positive effects on mental health. (Hasson-Ohayon et al., 2016)

Planting trees also gives communities the opportunity to regenerate our native bush, and this is critical for Aotearoa, where over half of its original native forest has been lost. Pre-civilisation settlement, over 80% of Aotearoa land was covered by native bush, and with rich native bush lands came vibrant wildlife. Thinking about restoring native trees and bush can be an opportunity for architects of the future to be agents in adapting nature in conjunction with designing environments. Thinking about regenerating agriculture alongside designing spaces not only benefits our communities but also our soils which then feeds our eco-systems through to our climate and into the future.

Indigenous knowledge

Understanding and adopting indigenous knowledge can also help civilisation with how we work with our environments in the future. Aotearoa is in a unique place with Māori knowledge on the rise in the public sphere and becoming more accessible to wider communities. For example, the Maramataka revitalisation is becoming increasingly widespread. Advocated by Dr. Rangi Matamua, Rereata Mākiha and a local of Te Arawa, Jade Kameta, they who have done the ground work to bring this ancient knowledge system in to the present day and into public and government recognition.

The Maramataka is a lunar-stellar or moon-star based system. Each month is represented by a star or stars who then have influence over that month. Maramataka is an 'environmentally led' system, where syncing with the natural rhythms of the environment is encouraged because for Māori the environment dictates what and when things occur. Tūpuna Māori were experts in observing and interpreting the environmental signals to understand the subtle shifts in time and phases and seasons. (Ngā Pātaka Kōrero Te Arawa, 2021). Maramataka is only one example of Māori knowledge that actively shows how our living systems are connected, from energy levels of people to our environments around us.

Kaupapa Māori

Kaupapa Māori is the term to describe the Māori ideology or Māori worldview that are underpinned by the connection of humans to the natural environment where people and land are seen as fundamentally linked. Sir Mason Durie (2003) describes the Māori worldview as the deeply linked connection between people and the environment that is spiritual as well as material. Within Te Arawa specifically, they believe that they descend from Ranginui and Papatūānuku, which holds a deeper reference to the connection to the environment. Māori connection to other entities like maunga, wai, whenua, and Rangi are spiritual more than physical. Rituals like karakia, karanga, waiata and haka are ways in which Māori connect spiritually to all beings of the natural and spiritual world. Linda Tuhiwai Smith, Waimarie Nikora, Ngahuia Te Awekotuku and Dr Virginia Tamanui within their report Home and the Spirit in the Māori World (2013) mention that "Māori Spirituality is about being present and in communion with all of life" (p.6). This leads to a greater awareness of self, thus understanding our positioning as humans and our duty to all natural and spiritual beings within Te Ao Tūroa and Ae Ao Kikokiko, the physical and spiritual realms. (Nikora et al., 2013).

It is not to say that living spiritually is easy, the challenge lies with positioning ourselves within our surroundings and beyond and to remain mindful of one's relationship with all things. When considering the spirituality of things, Māori use the term mauri or life force. Amanda Yates (2017) describes mauri as a living-world-assemblage or living mesh, where sky, sea, mountains, trees, people are part of a relational whakapapa. Whakapapa is a multi-generational genealogy, a taxonomic framework that binds all living beings, micro and macro, known and unknown phenomenon within the physical and spiritual worlds (Yates, 2017). Whakapapa is therefore a map of relationships weaving together myths, legends, history, knowledge and tikanga (customs) to be passed down to the next generations. It is mauri that binds our whakapapa to our more-than-human entities such as our environment including land, air and water-based species. Having an understanding of mauri, one will come to understand Māori living and way of life.

Figure – 8 Patuwatawata, Digital Photograph

It is important to understand indigenous knowledge when seeking solutions for indigenous people. This is echoed by Angus Macfarlane & Sonja Macfarlane (2019) who suggest that it is inappropriate when indigenous challenges are resolved within a Western knowledge system. They propose that blending Indigenous and Western bodies of knowledge could potentially create a more powerful approach to either knowledge stream. Macfarlane refers to his Braided rivers (Macfarlane et al., 2015) to represent the intertwining of the two streams and how we could possibly move between the two worlds of knowledge, because when there is knowledge comes understanding. This in turn reinforces the exegesis approach towards Māori knowledge as a pillar to guide the concepts and methods of co-occupancy, so that the research stays grounded and relevant to a Māori worldview.

Te Pō

Chapter Two

Now we arrive at TE PŌ, the transition point from TE KORE, nothingness, in to the impenetrable darkness. Within darkness lies limitless potential. Māori believe that the period of TE PŌ saw the first wānanga (deliberation, discussion) between the natural gods. TE PŌ looks to consider, discuss and address the themes of co-occupancy, doing so through the experience of place and relationships between entities and space. This section explores literature by Robin Wall Kimmerer (2013), and Soren Larcen and Jay Johnson (2017), considering how both pieces of literature establish a unique perspective on co-occupancy, with interest to the importance of place and time to indigenous people. This section looks to compare and contrast both writers' perspectives on the world while seeing relativity to the notions of the research, co-occupancy and how might one co-exist with the more than human world. The bulk of the chapter moves towards a methodology for co-occupancy and how the exegesis looks to the methodologies as foundational pillars for a papakāinga design approach. Completing this chapter are two sections, the first an introduction to the context of Te Arawa and Rotorua. The final section provides a background and conversation around papakāinga principles, looking to prior research of papakāinga may reinforce this exegesis approach when considering co-occupancy with communities and the environment.

Figure – 9 Te Pō (2021), Pencil to Paper

Co-occupancy of Place

The reading Braiding Sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants authored by Robin Wall Kimmerer (2013) is an expression of the potential indigenous philosophies hold for future living environments. Kimmerer (2013) explains this through speaking from the lens of an indigenous Potawatomi Nation woman, while weaving western understandings of science with an indigenous storytelling framework to illustrate indigenous philosophies accentuated by science to reintegrate known knowledge-based systems into the future. Through her native story of the falling lady depicting the beginning of life, Kimmerer (2013) emphasises the importance of how living and learning from the instructions of plants and the environment, expressing that we must "become indigenousness" (Kimmerer, 2013), not necessarily in the sense of claiming rights but more so understanding our position and the relationship to our taiao. Kimmerer's (2013) expression of knowledge and science through storytelling inspired this research to reflect and rethinking how this exegesis is working with Māori knowledge based structures and the importance of history, whakapapa and storytelling with in Māori culture.

Soren Larcen and Jay Johnson (2017) talk about the notion of place, firstly, highlighting the relevance of indigenousness world view with belonging to place, and secondly outlining how our survival is dependent on how we co-occupy our place in this world. This challenges us to think about place as a higher order of being which demands us to respect our responsibilities with our co-inhabitants (Larsen & Jonson. 2017). They talked to indigenous groups from different parts of the world to explore the diverse practice each one has when co-existing with not only place and our environment but also people and treaty partnerships (2017). A part of that research involved Ngāti Rahiri and Ngāpuhi at the Waitangi treaty grounds of Aotearoa. Larsen and Jonson explored how the Treaty of Waitangi (the Treaty) came to be but also how Māori, tangata whenua, the indigenous people of the land responded and how they are now living and fighting for the articles as articulated in the Treaty. Considering the articles of the Treaty and its impacts is important when we think about the importance of place. Māori have a strong attachment to place not only physically but also mentally and spiritually.

The loss of place is also a factor when thinking about turangawaewae and belonging in this world, because for many Māori, their turangawaewae has been stripped away from under their feet. Colonisation is a common

Figure – 10 Waingaehe forest, Digital Photograph

component of losing a sense of place. This leaves Māori being mindful of their role as guardians of Aotearoa soil and having to defend and fight for their rights to protection and ownership of their ancestral land.

Both braiding sweet grass (2013) and Being together in place (2017) address the notion of co-occupancy, but each with their own personal approaches. Kimmerer links co-occupancy through indigenous knowledge and science, looking to both topics as feeding one another, neither superior to the next because both fields speak of earth, one through storytelling and the other through western knowledge. While Larcen and Johnson (2017) draw from indigenous world views on place and how indigenous cultures adapted to colonisation, it is through both of these narratives where this exegesis draws inspiration from. In doing so, it propels the notions of co-occupancy into different and unconsidered fields before starting this research. These narratives bring attention to the beyond connotations about place and environment, seeking more than the physical elements of place and including elements such as the spiritual, mental and history of place. The narratives question how might these become considered elements within design and architecture, looking to co-occupy space and place physically, mentally and spiritually through life and life experiences.

Methodology

Co - occupancy

This section unpacks the methodologies of co-occupancy through materials, design and assembly. It aims to demonstrate an unorthodox approach to methodologies by delving into some of the possibilities for designing for co-occupancy and by thinking critically about creative practice through the notions of a life cycle. Implementing the life cycle of materials and our environment into the timeline of the project is used as a strategy to test how the stages of selecting materials and assembly can be thought about in different ways. Having this consideration grounds the project in the notions of co-occupying by not only experience in the present, but by having an understanding of the past and also the future. The chosen methods of using recycled materials, building for disassembly and Māori design techniques are inspired by projects such as Future Library, Effect Urban Village and Our Living Environment where each projects demonstrate the life cycle of a place.

Materials/Composting/Recyclable

Materials in architecture have a social, cultural, moral and environmental implications (Munn & Soebarto, 2004).

These implications have mostly seen the materials impacts disregarded by designers with the focus on performance, aesthetics and short-term economics of the materials. Architecture tends to overlook the implications of materials beyond the architecture itself. This exegesis will look to examine the origins and life cycle of potential and chosen materials.

This methodology encourages the lifecycle of materials to be considered within the process of design and development because building materials can affect our climate through waste production, disregarding the origins of the extraction and the creation of the materials. This brings attention to the small things, like considering where to source the materials, how the material evolves over time and how might the material be recycled or repurposed over time. Thinking long-term about materials in ways to be flexible with time can shape the way we look to architecture and our future living environments. This exegesis committed to the aspiration of sourcing, manufacturing and developing materials locally or, if not locally, taking into consideration where and how those materials were produced before reaching site and development. Considerations include bringing innovative technologies forward such as Scion in Rotorua, a research institute who specialise in research and science related to forestry technology, wood product and other biomaterials. This causes attention to be paid to who are developing new and innovative research around timber construction and connecting to the local timber mills in the area that are governed and supported by iwi corporations.

*Figure– 11 Harakeke, Digita*l Photograph

Being open to biodegradable materials such as hempcrete, and harakeke concrete drive an environmental focus for the project by using such materials like hemp and harakeke that can be flexible through time and can be lenient to the impacts on our environment. While Hemp is considered, the research also considers the fact that as technology evolves so will resources and materials. Allowing space for that evolution within the project is important especially when considering time and life of a project. Local material sourcing can positively impact economically and also environmentally. Growing materials, such as hemp, strongly contributes to the fight for carbon sequestration by greenhouse gas emissions. Large crops of hemp are associated with the ability to sequester high amounts of carbon through photosynthesis (Hemp Connect. 2020.) Using and thinking of materials such as this can also be an approach architects think about when we consider materials, a cycle where we grow, produce, use and recycle or repurpose and repeat. This can encourage architects to look forward to co-occupying with the environment around us, being able to shape and move with time and our surroundings and giving materials purpose even beyond the architecture itself.

Figure – 12 Oneone, Digital Photograph

Build for Disassembly

'Build for disassembly' as a methodology challenges the notion of what a design's purpose is in the future; how might it grow or evolve overtime?; what is its purpose and how is it constructed? This design research is interested in the potential of modulation and its relationship to building for disassembly. There have been many examples for modular housing and building of late, with the likes of Effekt Urban Village research (n.d) and more locally here in Aotearoa with TOA Architects and their Māori modular homes (n.d). However neither of these two companies consider the proposal of disassembly. The concept of designed disassembly has been put into action by Kraaijvanger Architects with their design of the Vinlo City Hall in the Netherlands (2011-2016). The project included a "green demolition " plan which provided directions on disassembly of the building to create a continuous cycle. The objective was that the building would become some form of material bank for the community. This offers an interesting way for how architects can look to disassembly as enabling designs to have the ability to provide for the future. There is an understanding that it can be difficult to design for a building's end date, but it is also exciting. When we are considering co-occupying our space with our environment, designing for disassembly allows growth and change when needed. Multigenerational living and modular systems or disassembly systems can help to sustain communities for the long term when considering the growth and challenges one community might face. Designing buildings with a cycle of circularity retains value by adapting to time, circumstances and environment and being able to look so far forward into the future allows the value of a building to be retained and extended.

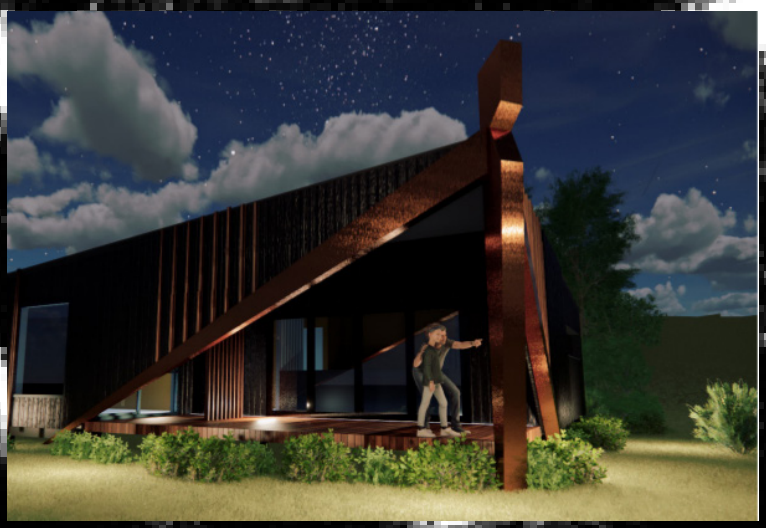


Figure – 13 TOA Architects, MMH

Figure – 14 Kraaijvanger, Venlo City Hall

Figure – 15 Effekt, Urban Village

Te Ao Māori

Māori knowledge and Kaupapa Māori methodology are a foundational part of this process because it is important to wrap this research with Māori methods and ideologies. Māori knowledge-based systems have a lot to offer to this space of architecture and our future environments. They can contribute to how Aotearoa might live and co-inhabit in the future. Māori knowledge and indigenous knowledge in general continues to have meaning for generations, evolving over time and still applied and adapted to contemporary conditions to then have meaning for communities in the present into the future (Smith et al., 2016). Indigenous peoples' expression of knowledge and history comes in a wide variety of ways, it can be uttered and woven through stories, songs, chants (McGregor, 2004).

For Māori, stories can remind us of who we and where we are from. Storytelling or pūrākau is not the only way knowledge is passed down, there is also the expressionist art forms such as tā moko (tattoo), raranga (weaving) and whakairo (carving) to carry on history and knowledge. Māori have also created an array of knowledge about the flora and fauna, and have their own categorising systems of methodology, Te Ao Tūroa (earth), astronomy, knowing one's self physically, mentally and spiritually (Smith et al., 2016). With this in mind, the design process of this research will be working with methods such as kōrero and wānanga to unpack knowledge that might not be accessible otherwise.

With the recourses of traditional Māori arts growing, especially with the New Zealand Māori Arts and Crafts institute based in Rotorua, possibilities are opened up of engaging with the school to integrate the knowledge-based systems of whakairo and raranga into this research, to then contribute to the overall culture and presence to this project. Bringing knowledge -based systems such as Toi Māori and pūrākau to the research grounds the project in Māori principles. From the evolution of the design over time, through to stories shared from the people to the building and its wider surroundings. Looking to Māori methods is a process that looks beyond the building but looking to the community. This methodology approach attempts to bring the romanticising nature of Māori knowledge to the writing and the design by unpacking the knowledge and then finding its place with the design process.

Figure – 16 Pou Whakairo, Digital Photograph

Biophilic Design

Biophilia expresses an innate and genetically determined affinity of human-beings with the natural world. (Wilson, 1984).

Biophilia as a methodology keeps the connection to nature strong and not something to be disregarded. Biophilia is more than connection to nature, as it has been proven that biophilic design supports mental, physical and spiritual wellbeing (White & Heerwagen, 1998). This is important to consider when the foundation of this exegesis is underpinned by the notion of co-occupying with the more than human. The importance of biophilic design has the power to influence the design outcome to lean towards nature and our wider environment, and consider how the design might interact with nature. The discussion around biophilia is typically concentrated on the natural environment without the inclusion of animals (Ulrich, 1993). But when considering biophilia or nature, there is the opportunity to think about nature and what entices certain animals to interact, such as the likes of bird activity.

Thinking more strategically about the biophilic distribution required considering how species might interact with it. Looking beyond the aesthetic nature of biophilic design goes deeper into the purpose of why, whether it was for mental purposes or for function. These are questions that have to be constantly thought about when thinking about the inclusion of greenery or nature to the design.

Through the development of biodiversity as a methodology, biophilia challenges the way in how the research approaches nature, and how it is incorporated with in the design. Example such as the Tsuruoka House show how architecture can house ecosystems from the materials it selects right through to the inhabitants occupying the space above and below. This example becomes an influence as to how the project might house its communities and how it encourages interactions between human and more than human such as, thinking about garden beds imbedded within the flooring through the verticality aspects of a building, providing soil for vegetation growth indoors and outside, as well as thinking about rain gardens to channel water to provide natural water infiltration and treatment to be repurposed and recycled. Understanding of our connections as humans with nature and the wider environment can reveal co-occupying eco-systems as a potential within design.

Figure – 17 Kiyoaki Takeda, Tsuruoka House

Figure – 18 Kiyoaki Takeda, Tsuruoka House

Te Arawa - Ngāti Ohomairangi

Chapter Three

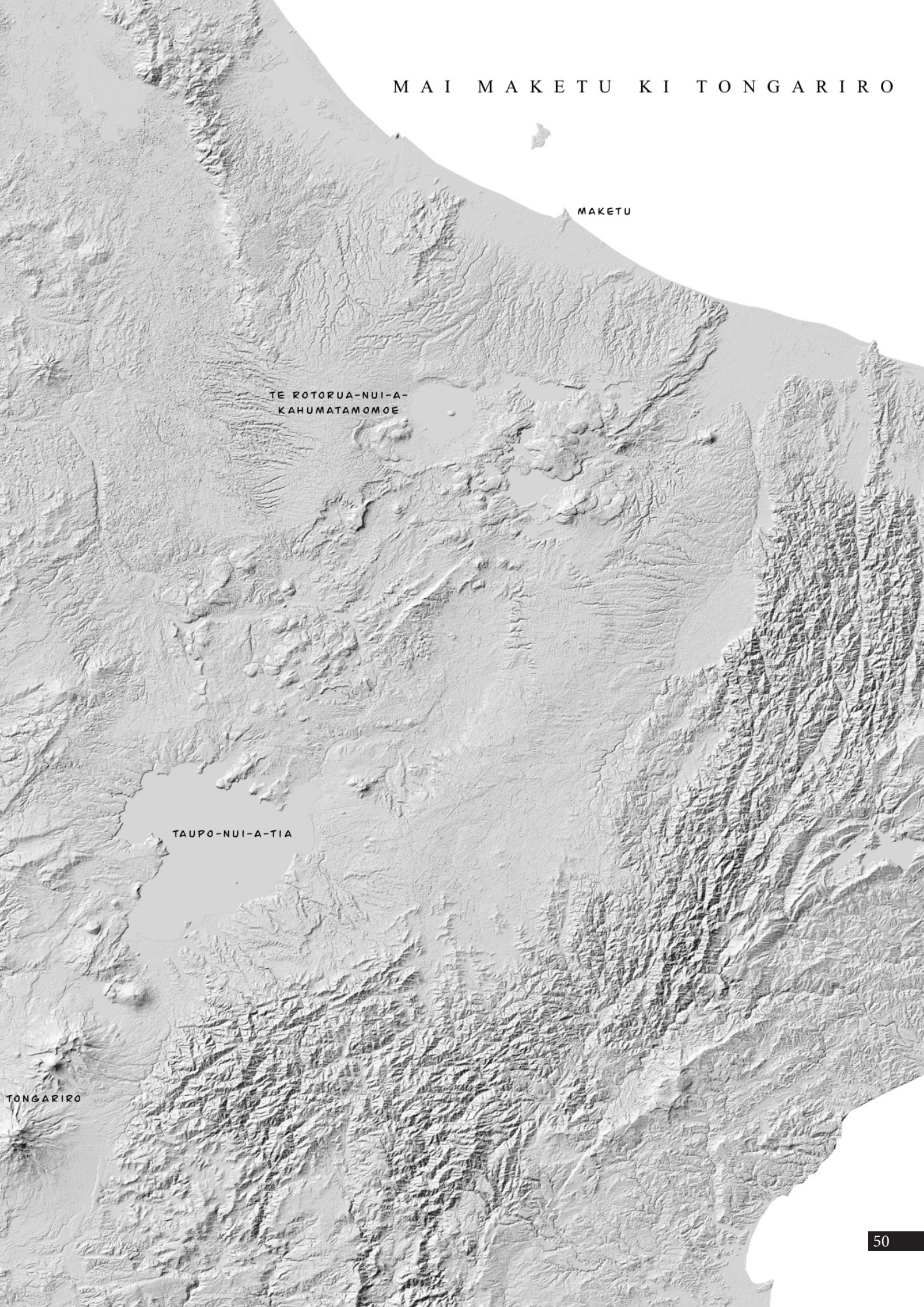
To know Rotorua, first you need to understand the origins of Te Arawa people. Te Arawa is the name of the ancestral waka (canoe) that was a part of the great migration from Hawaiki, the Māori ancestral homeland, here to Aotearoa, New Zealand. The name Te Arawa was the second name of the waka, named after the mangopare, hammer head shark that guided the waka safely to Aotearoa, and was then bestowed on to the Te Arawa people who were known by the name Ngāti Ohomairangi. The original name of the waka was Nga Rakau e rua a Atua-Matua translating to the two canoes of Atua-Matua. Atua-Matua was the grand farther of the two chiefs who were in command of the Te Arawa waka, who were Ngatoroirangi and Tamatekapua. Ngāti Ohomairangi, now known as Te Arawa people, believe through their whakapapa (genealogy) that they descend from the heavens or the land of the gods. Not gods of the generic term, but atua Māori. They believe that Pūhaorangi descended from the heavens to breed life with a maiden by the name of Te Kuraimonoa, and Ohomairangi was a product of that relationship.

The Te Arawa waka landed at Maketu. Some of the Te Arawa people stayed and settled at Maketu while others left in search of new land and settlements for their people. Te Arawa chief Ngatoroirangi travelled in land as far as Tongariro maunga, and Tamatekapua went across the Coromandel coastline ending up near Kawhia and Whitianga area. There are many Te Arawa settlements across Aotearoa, but the region where Te Arawa people mainly lie is in the central North Island, mai Maketu ki Tongariro - from Maketu to Tongariro.

Tribes of Te Arawa can align their genealogy to the infamous ancestor Rangitihi who was the great, great grandson of Tamatekapua, the commander of the Arawa Waka. Rangitihi is also known by the name Rangitihi Upoko Whakahirahira i takaea ki te Akatea (Rangitihi whose head is bound with the akatea vine) (https://teara.govt.nz/en/volcanic-plateau-region/page-4). This name was given after a battle where Rangitihi head split from a blow to the head, and his son Apumoana bound it back together with an akatea vine. Rangitihi married four wives and had eight sons. From these unions, comes the reference to the eight beating hearts of Te Arawa - Ngā Pūmanawa e Waru o Te Arawa.

Figure – 19 Te Arawa (2021), Mixed Media

MAI MAKETU KI TONGARIRO



Te Rotorua-Nui-a-Kahumatamomoe

Te Rotorua-nui-a-Kahumatamomoe, abbreviated to Rotorua, is located within the Te Arawa region and received its name from Ihenga, a great navigator and chief of Te Arawa decent. He stumbled upon Rotorua after just discovering another lake that named Te Rotoiti-i-kite-ai-e-Ihenga i ariki ai a Kahumatamomoe, the small lake discovered by Ihenga in honour of Kahumatamomoe, his uncle and son of Tamatekapua. After discovering Te Rotoiti, Ihenga then came across a second lake that he also named in honour of his late uncle Te Rotorua-nui-a-Kahumatamomoe, the two lakes of Kahumatamomoe. It can also be translated to the 'second lake' depending on how you want to perceive the naming.

Rotorua is one of the many places settled by Te Arawa people. It was a prime location because of its freshwater resource, and also the high geothermal activity within the area, providing warmth and later cooking opportunities. As a result, Rotorua was highly prized, desired by many hapū and iwi of Te Arawa. Lake Rotorua is surrounded by volcanic geography and believed to be in the centre of a volcanic cone. The community is built over a large source of geothermal activity which was fundamental to the sustainability and lifestyle of pre-colonised Te Arawa people. The geothermal active presence within the community of Rotorua is evident with the placement of pā and villages like Ohinemutu and Whakarewarewa that actively interact with the geothermal presence, accessing these resources for cooking and healing purposes.

Rotorua is now a fundamental part of the tourism economy, developing since the 1800s with the introduction of Europeans and the Crown. The occupation of the Crown in Rotorua has a complex history. This relationship began in the early 1880s with the arrangement of the Fenton agreement which was signed by iwi and hapū such as Ngāti Whakaue, Ngāti Uenukukōpako and Ngāti Rangiwewehi with the presence of Chief Judge Francis Dart Fenton. The Fenton Agreement is a treaty like document specifically for Te Arawa people and the Crown. Rotorua's history was built on this unique relationship between the Crown and local iwi and tangata whenua. From the positives to negatives, The Fenton Agreement is a testament to Te Arawa forward thinking and willingness to work together, but opportunity for change or growth for Te Arawa within Rotorua is still wanted. The implementation of Te Ao Māori and Kaupapa Māori within the daily life of the people and the environments they inhabit is an aspiration for the future of Rotorua (Stafford (1967).

Figure – 20 Rotorua (2021), Mixed Media

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Te Arawa 2050

Te Arawa 2050 vision attempts to capture the aspirations of Te Arawa people, their hopes and dreams for the future of their people, economy and land. Te Arawa people's strength derives from their whakapapa and culture, their belonging and their upholding to their traditional knowledge and stories. The 2050 vision was an opportunity for Te Arawa to catch the perspective of their people for the future of their place and life. The Te Arawa 2050 vision was launched in July 2020, with its seven values identified as goals and themes for the future of Te Arawa in 2050.

Ngā Mataapono

1. Te Arawatanga – Culture
2. Te Arawa Tangata – People
3. Te Arawa Takiwā – Place
4. Te Arawa Ōhanga – Enterprise & Economy
5. Te Arawa Urutau – Technology and Innovation
6. Te Arawa Rangatiratanga – Leadership and Influence
7. Te Arawa Tūhononga – Unity and Connection

These goals and aspirations shared by Te Arawa are inspirational and show a considered approach to the wellbeing of all, not a few. This empowers future generations by providing them with the tools to succeed and aspire to greater opportunities for their whānau, hapū and iwi. This vision also provides a strong and positive foundation for design and architecture. Aligning with the Te Arawa 2050 vision's values for the Papakāinga, holds the pā accountable and assures that the wellbeing of all beings is prioritised to create a healthier future for Te Arawa.

Papakāinga - Pā & Kāinga

The term papakāinga is associated with Māori housing and living environments. Papakāinga simply translates to "land" and "home" and is sometimes shortened to pā (Awatere, et al., 2008). Unlike traditional pā where the sustainability of the village is dependent on the resources available, more recently papakāinga are family dwellings on family-owned land with the prominent focus being on family and having a space that is shared and passed down through generations. Others are iwi and hapū led, where the housing of descendants are the priority, targeted to get families back living on Māori land attempting to create a small village or pā.

The history and themes of papakāinga stems from traditional Māori pā and kāinga. Pā were believed to be a "true stronghold," predominantly constructed on hills and fortified hills, and palisaded earthwork was commonly used for the establishments of pā. Hills were prime sites and locations for security and view of their surroundings. (M, Kolb & B. Dixon, 2002). European Representation of the Architecture of Hākari (1999) authored by Sarah Treadwell refers to Pā as massive architectural constructions and an architecture of the land. The security of the people was paramount but pā were also constructed to protect their resources and crops. Storage and gardening of its produce were fundamental to the purpose of a pā, and in some instances pā were specifically built to protect resources or artifacts. (Best, E. (2005). The connection to environment was important, including the access to resources on land and water. It was common to locate pā near water or resources and produce that could be beneficial for the sustainability of the pā. Pā were dependent on resource levels, topography and populations to validate the territory it was occupying. Pā were believed to be strongholds and marae and the properties we associate with marae can also be associated with a pā. They were important to iwi and hapū in many ways, including culturally, ceremonially, symbolically and at times defensive purposes.

Kāinga

Kāinga (village/home) on the other hand were understood as settlements that aren't seen to use earthwork to such a large scale seen within fortified villages. That is not to say earth-working wasn't used, recessed whare were a means of earth-working in the colder areas and earthing practices, such as hāngi and rua, were also evident throughout kāinga.

How both kāinga and pā worked and were organised was based on their daily schedule, and influenced by the Maramataka. The maramataka is the centre of Māori life and knowledge of time. Time wasn't the only element measured by the maramataka. The maramataka identified the rhythm of the environment, and dictated to pā what they could do and when they could do it. Indicators such as planting crops, being active and settling down come from the environmental signals to understand subtle shifts in time, phases and seasons (Ngā Pātaka Kōrero Te Arawa, 2021). The influence of reading the sky also provided indicators to where pā or kāinga should be established. Key landmarks were chosen for their view of the sky or what the environment provided to them when working with the rhythms and phases of the year.

Figure – 21 Whakarewarewa kāinga, Digital Photograph

Papakāinga

Papakāinga developments today look to create living environments that somehow connect to traditional pā and kāinga. Currently the term 'living' centralises itself around housing, which means shelter and refuge form the elements dependent on climate. The way we perceive and value housing varies between cultures, shaping our perception and requirements.

From a Māori perspective, the inclusion of their environment, culture, society and spiritual wellbeing tend to take priority over economic and financial benefits. Comments from iwi indicate strong connection to whānau, whenua, identity, whakapapa, multigenerational and opportunities to live within and on traditional landscapes. (Awatere, et al,. (2008). The aspirations of iwi, hapū and whānau are important when thinking about developing a papakāinga, but also providing iwi and whānau appropriate solutions to living on whānau land.

For the project of the exegesis in relation to Wharenui Rise in Rotorua, the Pā proposals look to provide solutions when it comes to the use of land. Typically, with a site like Wharenui Rise, a typical papakāinga development would look to low to medium density designs where the housing can be spread across land which is good to provide space and flow between homes. However, that limits the growth opportunities for the papakāinga. This exegesis aims to propose a PĀ that will bring an unorthodox approach to a suburban semi-rural community with the proposal of medium to high density design, looking to vertical typologies to house and locate a higher number of whānau on a smaller section of land, allowing opportunity for future growth and diverse usage of the land. Proposing higher density living grows the opportunity for alternative land use with the aim of restoring the natural surroundings with regenerating the native bush within the area and more. This is especially relevant when iwi and hapū are wanting to retain their community, and also provide homes and living space for their people when they return to their tūrangawaewae. The PĀ proposal will provide a solution to that desire. The opportunity of having more land area also provides a chance to self-sustain a community with the inclusion of mārakai, food and water storing. Thinking about the design as a holistic life cycle allows synchronisation with its surroundings.

Papakāinga design principles

This research would like to acknowledge the work that has already been done by past Māori researchers and designers who have proposed and shared papakāinga principles which are suitable for all Māori communities, if not all communities Māori or non-Māori. Shadrach Rolleston and Shaun Awatere case study Ngā Hua Papakāinga: Habitation design principles (2009) proposes principles to consider when working with Māori land and Māori communities. I would also argue that these principles should also be principles used through all developmental work because of the benefits they have to a project, and how they bring a sense of awareness of a wider context like land and our environment other than the specific project itself.

The design principles are themes such as:

- Kotahitanga – Cohesion and Collaboration
- Wairuatanga – Embedded Emotion/Spirit
- Manaakitanga – Hospitality and Security
- Whānaungatanga – Participation and Membership
- Kaitiakitanga – Guardianship and Stewardship
- Rangātiratanga – Leadership, Identity and Self-Determination
- Mauritanga – Essence/Life-Force
- Orangatanga – Health and Well-Being
- Mātauranga – Knowledge and Understanding

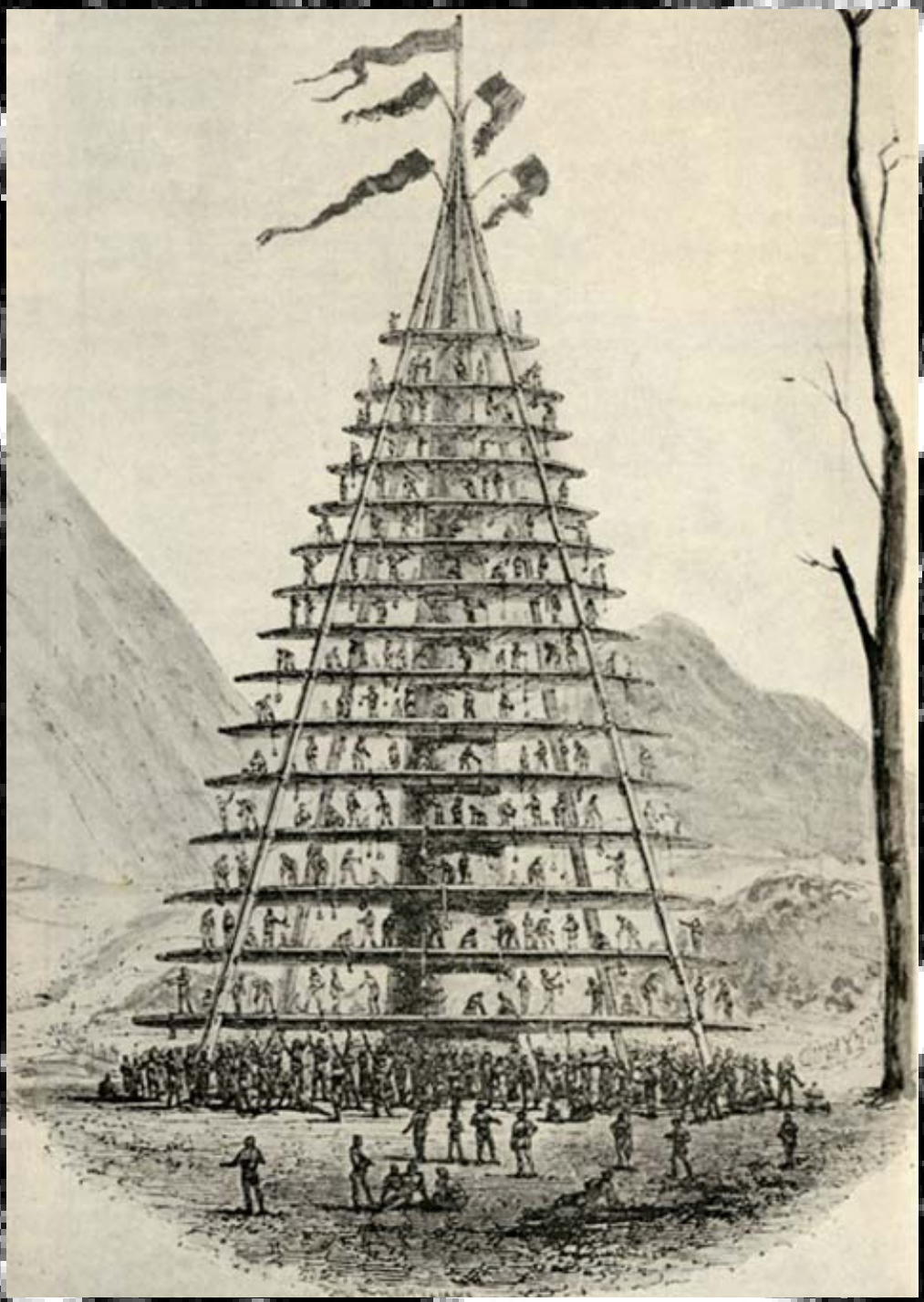
This model has the ability to keep projects connected with Māori values and holds developers accountable for their decision-making in relation to land, culture, society and spiritual wellbeing (Rolleston, Awatere. 2009). Principles of Mātauranga are important notions to consider when recognising iwi knowledge. Mauri is also an essential concept for a successful papakāinga model. Within the research the mauri model is used within to resonate with whānau and iwi when considering papakāinga. This model was also used to guarantee the prioritising of the aspirations and underlining principles identified by whānau and iwi. It is important that Māori determine their own living environments, and the mauri model along with the papakāinga principles mentioned earlier allows their aspirations to be identified in terms of what is important to the iwi.

Tapu. Noa.

While thinking about creating vertical pā, the notions of tapu and noa need to be brought to the forefront, especially when considering a Māori living environment. Tapu is a state of restriction and upmost physical and metaphysical sacredness. Whereas noa is the opposite, considered to be "unrestricted" and "profaned" (Mitira, 1945) These notions create spiritual guidelines that protect tikanga and kawa, which are important foundations and worldview for Māori and how Māori interact with their surroundings and behave. When going vertical, we must acknowledge the interactions of tapu and noa within a vertical setting. Therefore - notions like people walking over the body of another is considered tapu, with the head being the most tapu as that is recognised as the strongest connection to our spiritual entities. Other qualities such as having food above people are also unheard-of with in the modern Māori context (Mitira, 1945). However when we consider traditional food storage methods such as pātaka kai and hākari structures are examples of vertical structure that iwi utilised a key part of showcasing and recognising mana within an iwi when hosting manuhiri (guests). Such hākari structures were at a massive scale and were constructed not only to store food but in some cases were used as eating platforms. This reflects a boundary of where aspects of tapu and noa are seen in the same space however divisions are created which limits breaches of tapu within a vertically posed whare.

Figure – 22 Pātaka kai, Te Ara

Figure – 23 Hākari Structure, Te Ara

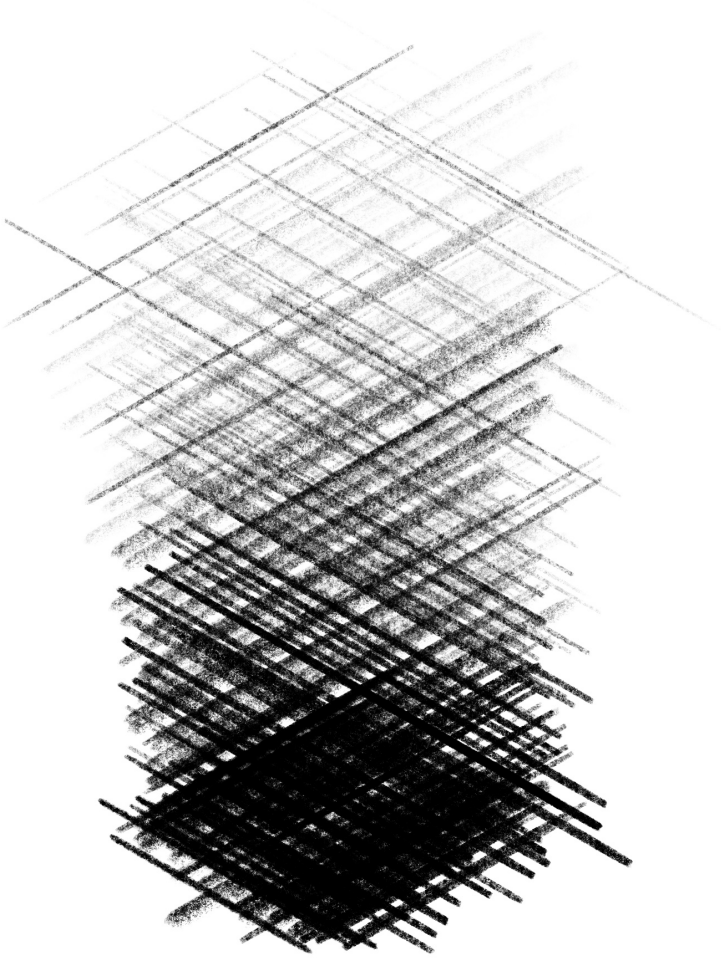


Te Ao Mārama

Chapter Four

From the everlasting darkness of TE PŌ comes TE AO MARAMA, a moment in time where light was first seen, endless opportunities and possibilities. The moment in time where all things that came before are woven together creating our world we know today. Like TE AO MARAMA, this chapter looks to weave all the research from TE KORE and TE PŌ into the design process to enforce ideas and shape the project, as it evolves into a design proposition that entails the concepts of co-occupancy with the added notions of Ranginui and Papatūānuku. The goal of this being to produce a Vertical Pā design that encourages interaction with the ecological and socio-cultural structures, providing a design that lives and adapts through generations - The Living Pā (the Pā).

This chapter explores the ecological practice that is desired for the life of the theoretical project, from its inception through to its assembly, construction, and deconstruction. This design chapter has been split into two parts. Part One focuses on the ecology practice of the project, where site mapping, research and reforesting is addressed to provide context and life cycle approach for the Pā. The second part of this chapter looks to define the design approaches of the Pā and its connection to its environment through the concept of designing for co-occupancy. Lastly, finishing with an expansion on how the elements of Ranginui and Papatūānuku are manifested and explored within the project.



Ecological Mapping

The project engages with Ngāti Whakaue section, Wharenui Rise, located on the Southern East side of Rotorua. Ngāti Whakaue are currently working with Te Tatau o Te Arawa on the future development plan for the East side areas of Rotorua, based on the overarching Ōwhata land block where there is anticipation of a mix of developments, with the likes of residential and commercial opportunities being built on the land. The position of my research is to help provide support with possible design approaches to inspire the development's progressions. The Living Pā is envisioned to be located near the Stage One and Two development proposal sites at the edge of Wharenui Road.

The project engaged with mapping when researching the site to operate within the spaces of potential and possibility. The functionality of the mapping process was to locate the site in context to its surroundings above, below, inwards and outwards. Working with themes that were previously expressed: ecological, social and cultural (Māori), to formulate and realise design potentials and alignment with the notions of co-occupancy.

Through this journey of research and mapping, I found myself delving into the site's opportunities and connections environmentally and culturally, referencing the vast scope of the site, which in turn led to the realisation and acknowledgement of the scope this project is dealing with. There was no intentional design purpose for the mapping process, however the notions of co-occupancy and Ranginui and Papatūanuku provided a framework in guiding the work forward. The maps produced are on one hand technically grounded in information constraints, while on the other, a visualisation unbound by the particulars but inspired by the connections. Thus, creating visuals to communicate information by also expressing the wider geographical context of the site.

Figure – 24 Te Ao Marama (2021), Pencil to paper

Hononga/Connection

The Ōwhata land block is situated on the southeast side of Lake Rotorua and has a clear line of site to Mokoia, looking back to the west side of Rotorua, with Ngōngōtahā standing tall in the distance. These connections to the wider context of Rotorua and its history are important for this project to ground it within the narratives that come from such significant sites. Rotorua is an example of village community, Māori culture and examples of traditional co-occupancy which reflect how Te Arawa iwi and hapū established Pā within the environmental context. With the example of Ohinemutu and Whakarewarewa pā established near geothermal activity. Traditional living methods utilised natural resources within the surrounding environment to enhance the sustainability of the Pā and its occupants. It is important that this project identifies some of these examples and pinpoints significant areas within the Rotorua catchment that are pivotal in Rotorua history and whakapapa. These connections pay homage to the importance of taiao, whenua, maunga and wai to Māori, as they are considered central aspects that shape iwi and hapū identity.

Figure – 25 Hononga Site Map (2021), Mixed Media


Ōkere
Matawhaura
Awahou
Te Motu-Tapu-a-Tinirau
Ngongotahā
Ōhinemutu
Wharenui
Puketāwhero
Whakarewarewa
Tarawera

Beneath Papa

Podzols
Podzols are strongly leached acid soils that occur under high rainfall. The soils are used for dry stock grazing, dairying and forestry and is predominantly found on the south-west of Rotorua and the Mamaku Range in the north-west.

Pumice soils
Pumice soils are dominated by one pungapunga (pumice) high in volcanic glass. Like allophanic soils, they have very low nutrient levels. Erosion by water is a high possibility with this soil especially when the surface thin topsoil is removed. Pumice soil is found on the north side of Lake Rotorua, to the hills around Ōkahu Bay near Rotoiti.

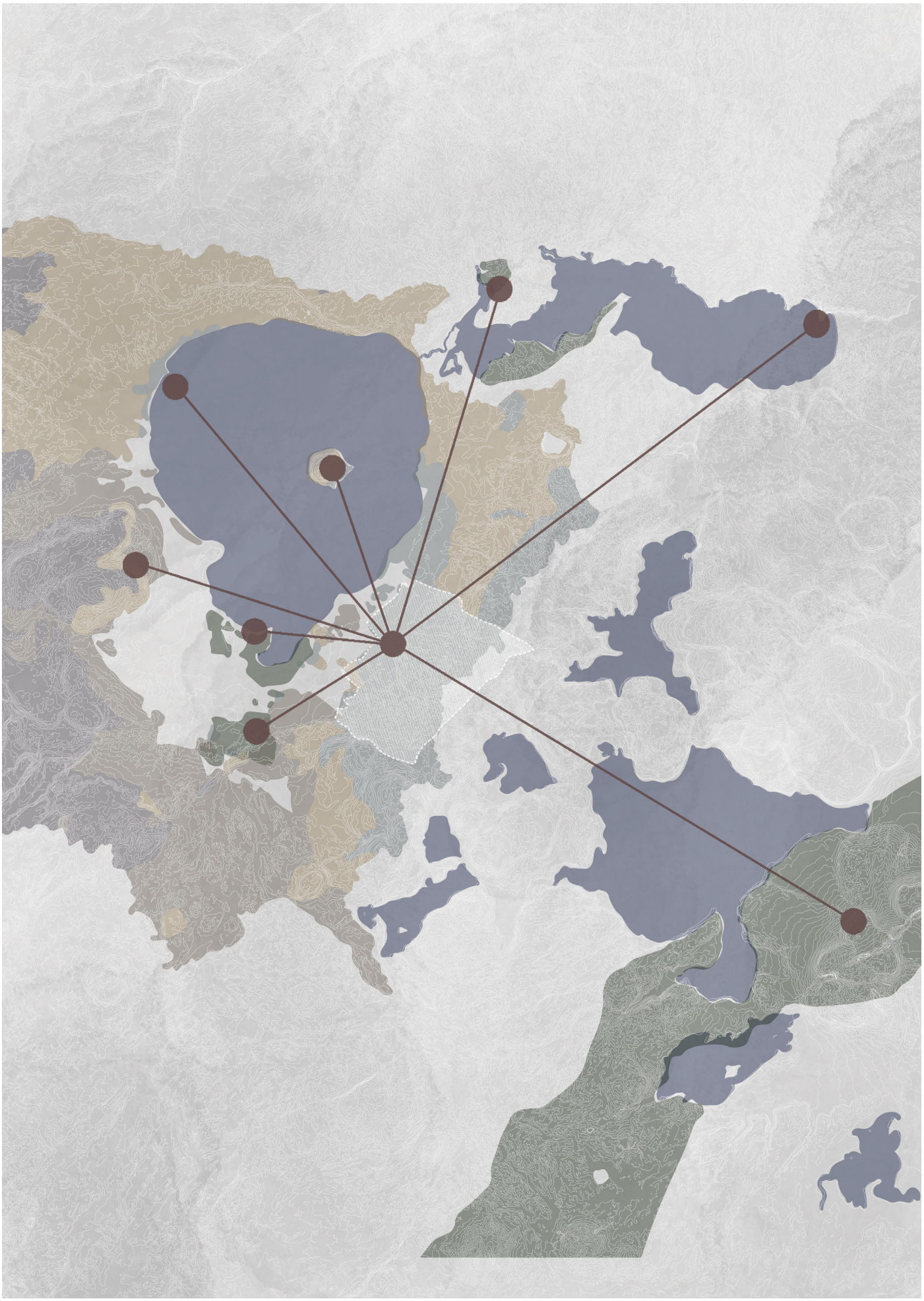
Recent soils
Recent soils are among the most versatile soils in the Lake Rotorua catchment and fortunately for the project, it is based primarily on the south-east hills of Rotorua and around Lake Tarawera. Much of this area is indigenous land and forest. The properties of the recent soils include weak soil development, high base saturation, high potential rooting depth, good drainage, low phosphate retention, high fertility and susceptibility to erosion and sedimentation.

Allophanic soils
Allophanic soils are strongly influenced by clay minerals that are poorly crystallised and also have weak soil strength.

Active thermal areas

(Environment Bay of Plenty (2010)).

Figure – 26 Soil Map (2021), Mixed Media



Wharenui Rise

Wharenui Rise is located on the boarder of Te Ngae on the east side of Lake Rotorua and is between the natural possibilities beyond and over the hills of Puketawhero. This site holds many iwi and hapū histories that are tied to this whenua, including that of Ngāti Whakaue, Ngāti Te Roro-o-Te-Rangi, Te Ure o Uenukukōpako and Ngāti Pikiao. Some histories derive from conflict and blood shed, which gives meaning to the name Puketawhero; the hills painted red. Others stem from custodial mana of the Waingaehe awa. The chosen site is placed adjacent to the green band sheltering the Waingaehe awa to enable interaction with the natural reserve but also creating an opportunity for reforestation complementing the green band to sit amongst or if not influence the up-and-coming development in the future. This is an important move because being next to the river enforces the notions of kaitiakitanga and manaakitanga not only to people but the surrounding environment.

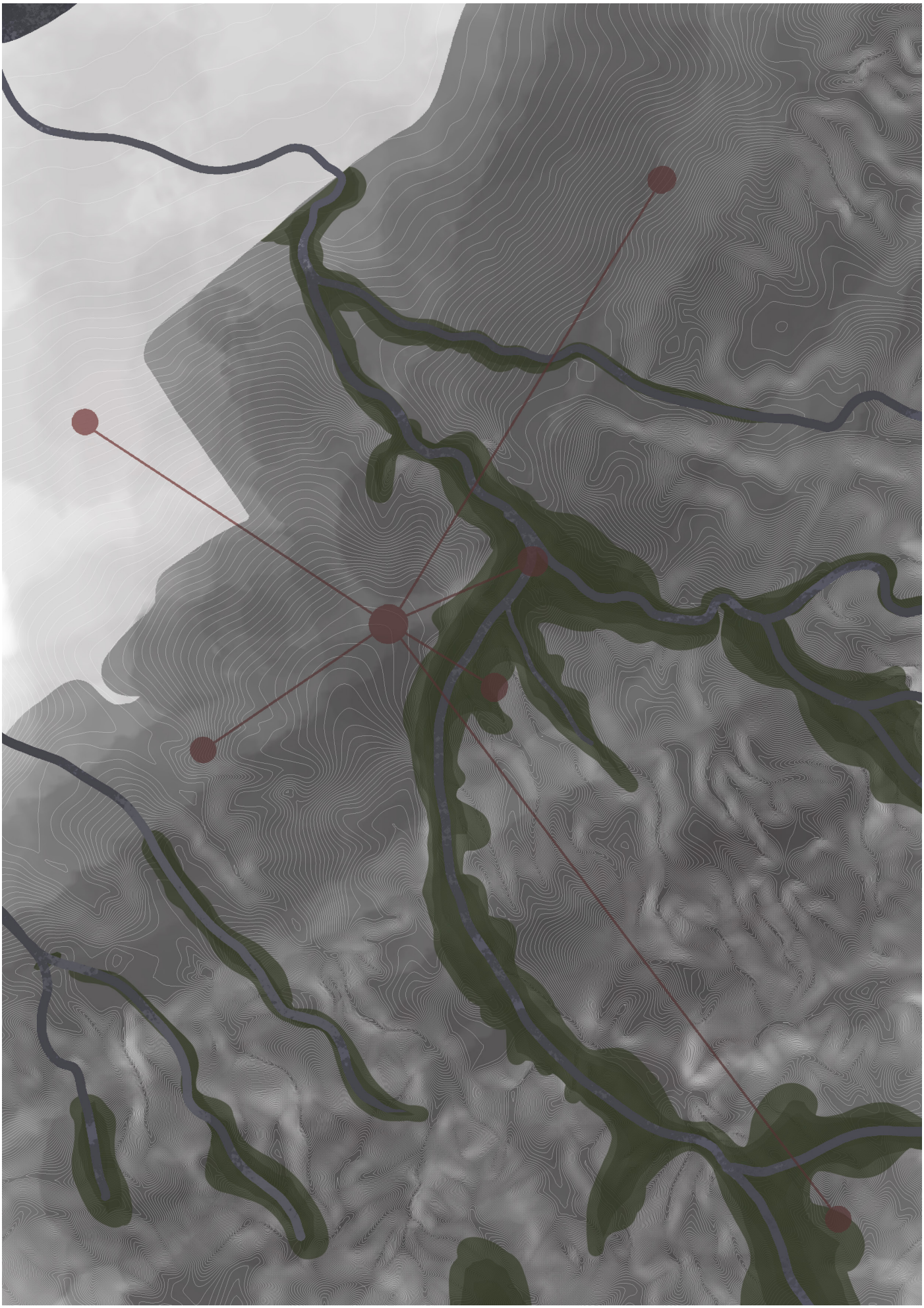
Figure – 27 Wharenui Rise Site Map (2021), Mixed Media


Future
Te Ngae
Ngahere
SITE
Puketawhero
Wharenui Rise Developement
Waingaehe

Beneath Papa

- **Recent soils**
- **Tree line**
- **Wai/awa/roto**
- **Te Ngae Suburb**

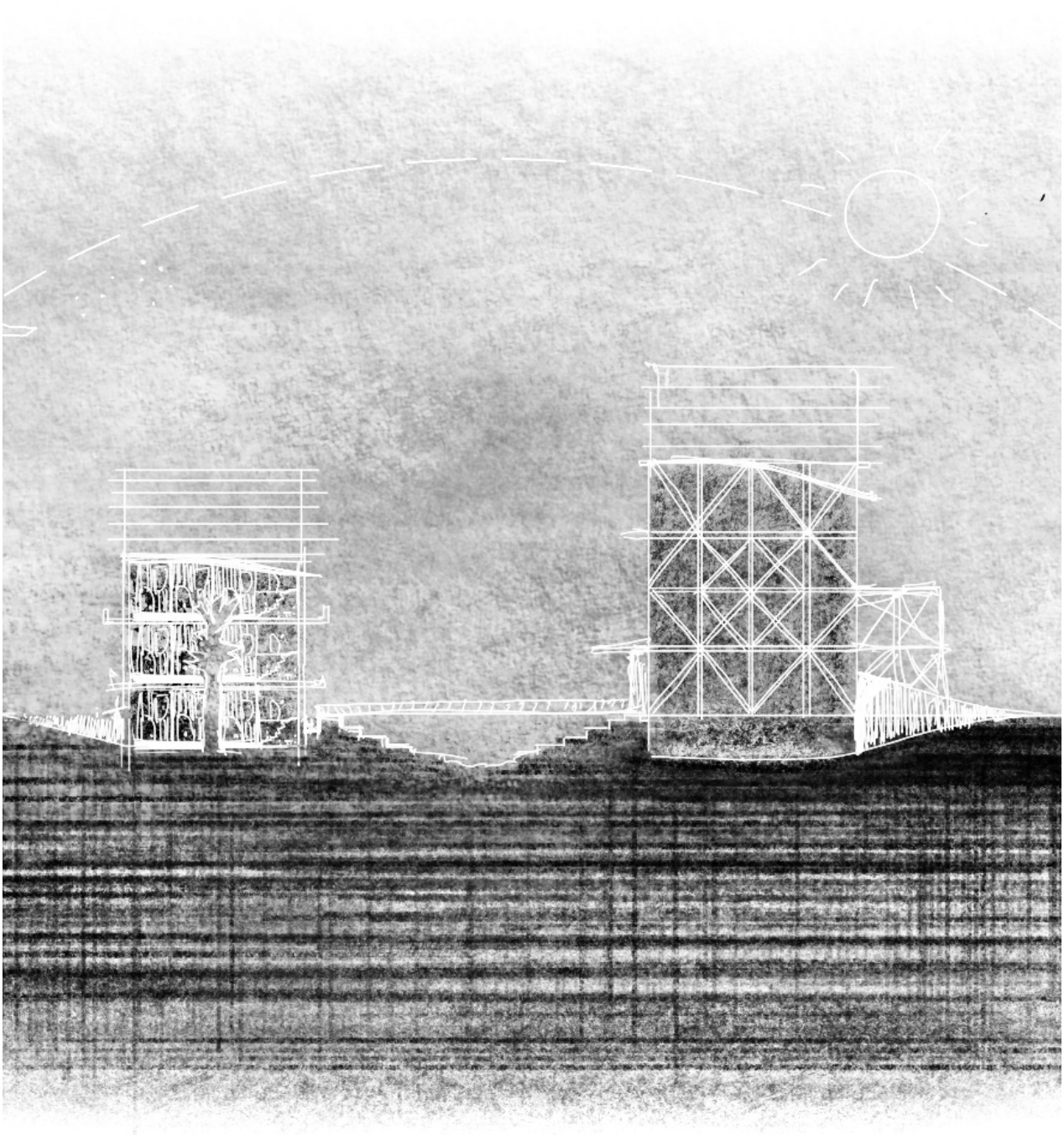
Figure – 28 Surroundings (2021), Mixed Media



Spatial Response to Co-occupancy

The key theme of co-occupancy, living between Ranginui and Papatūānuku, takes heed from the site context and placement, provides organic inspiration and influence regarding design options. Starting with "drawing for co-occupancy", sees the experience of co-occupancy illustrated through image creation, collage and modelling. This fleshes out the concept of relationships between space and place through the expression of drawing. Next, "program for co-occupancy" is discussed, addressing what this may look like in order to design spatially and thinking about where and how might relationships and connections happen with nature. The chapter concludes with the elements of "Ranginui and Papatūānuku" and how the Pā addresses such notions through the design and spatial arrangement in how the Pā will be living between Rangi and Papa while exploring roof gardens, water catchment, earthwork and biophilic design.

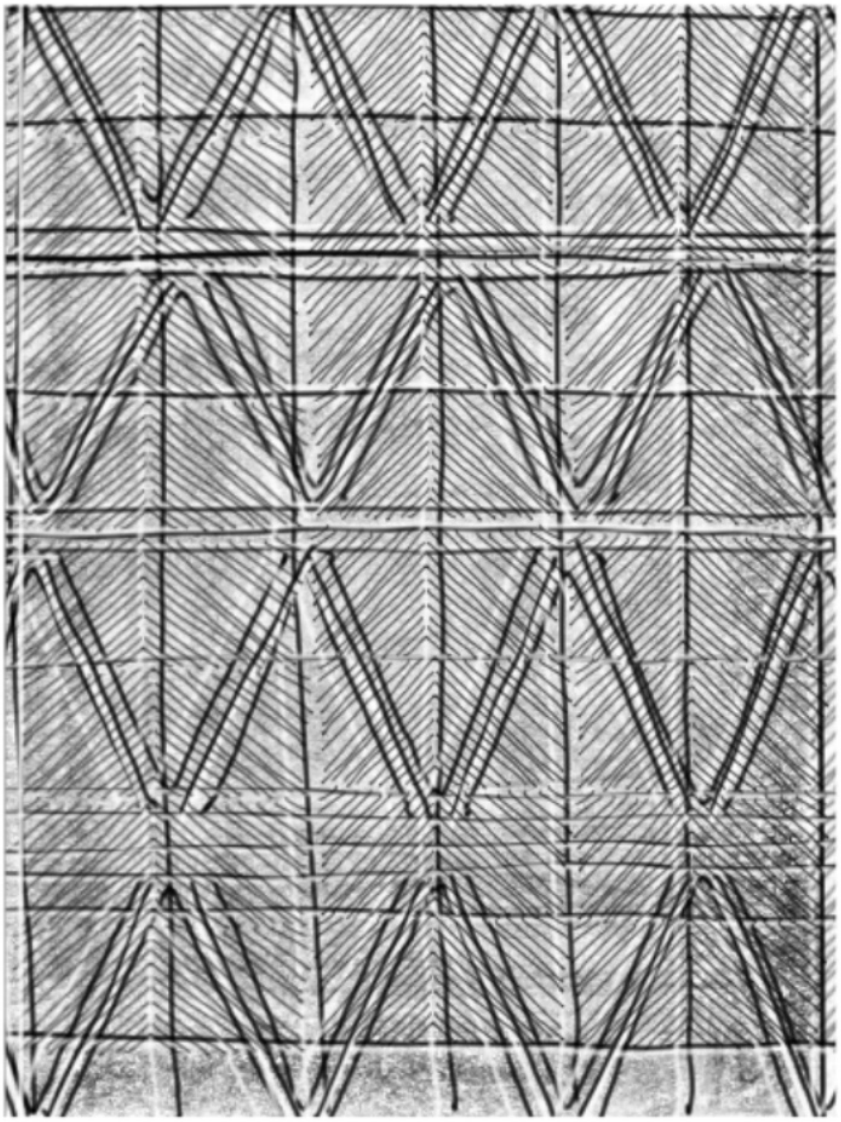
Figure – 29 Co-concept (2021), Mixed Media



Drawing for Co-occupancy

Drawing for co-occupancy recalls detailed accounts of all the different processes I undertook toward the final design. This saw me thinking of drawing as an expression of mediums, using collage and drawing techniques such as pencil and painting to develop ideas and visualise the notions of co-occupancy on paper. Using these forms of drawing progressed ideas and concepts forward to convey the theme of co-occupancy within a living environment. This work also posed solutions for how these theoretical notions can be physically represented within a final design. This process is important because it allows freedom to express ideas quickly while allowing me to think about the wider context of the site, being able to draw on environmental elements within the drawings by being able to design in relation to environment. This resulted in a focus on the connection between entities rather than the design of a structure, which highlighted the theme of co-occupancy.

Figure – 30 Ponga sketch (2021), Mixed Media



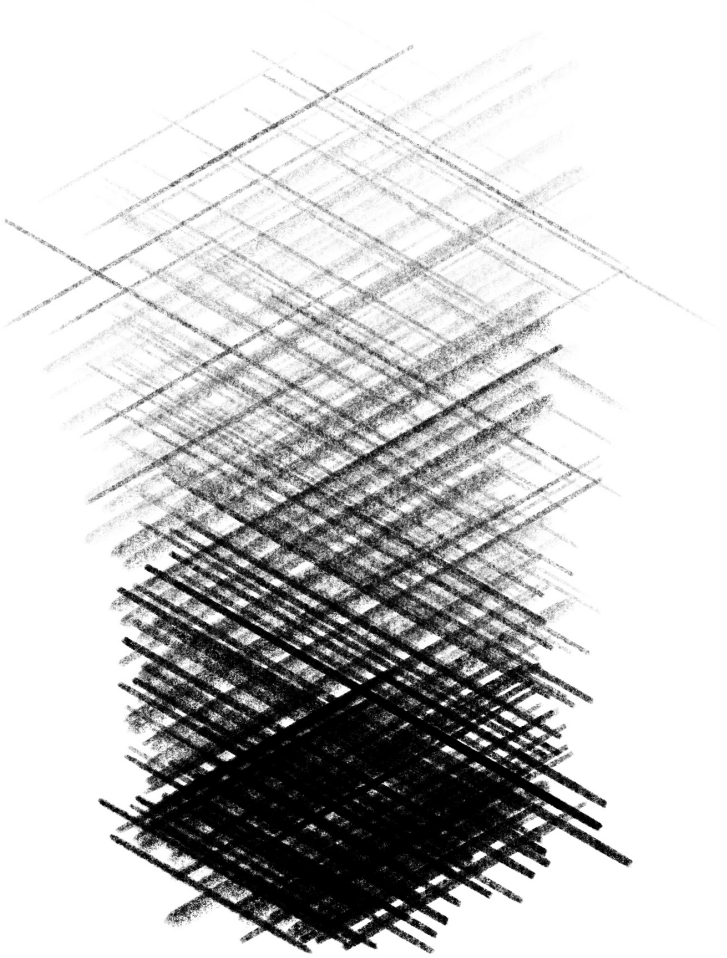


Figure – 31 Rangi/Papa (2021), Pencil to papper

Figure – 32 Hononga Taiao (2021), Mixed Media

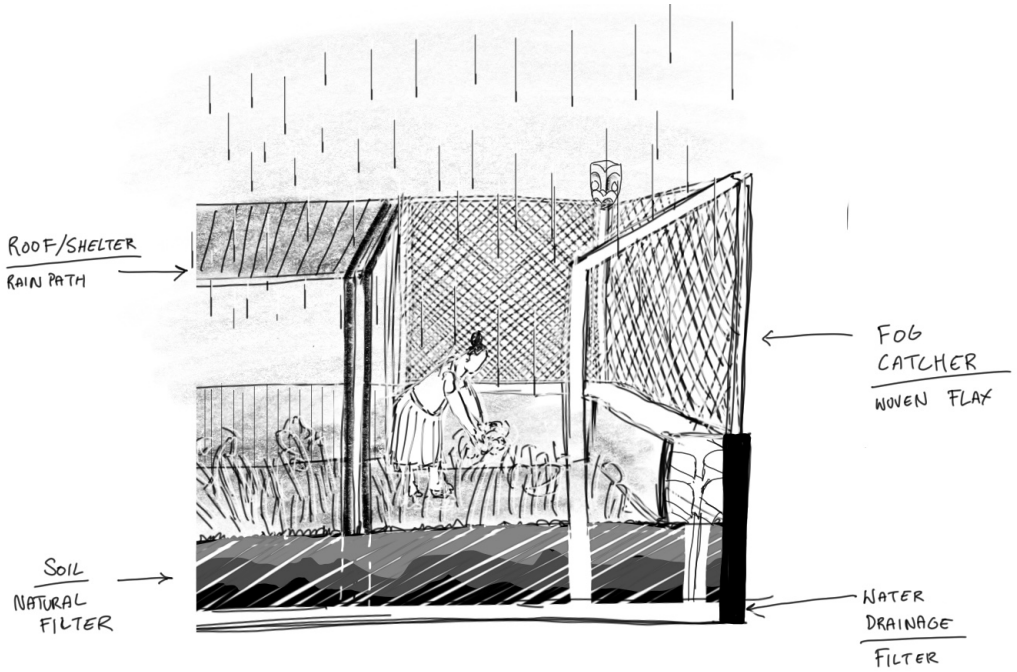


 Figure – 33 Rangi (2021), Mixed Media

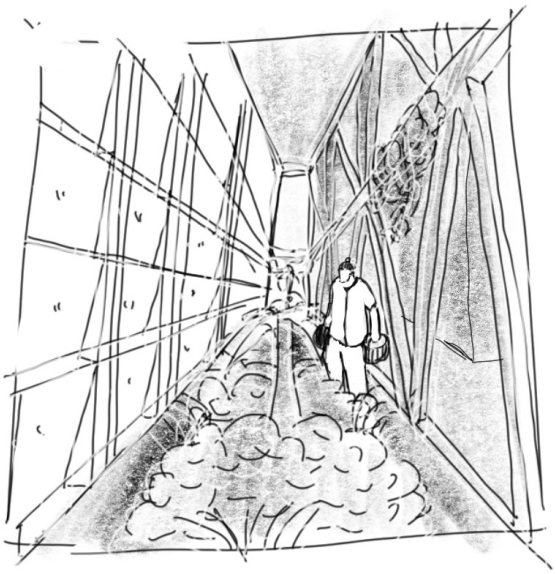


Figure – 34 Māra Kai (2021), Pencil to paper

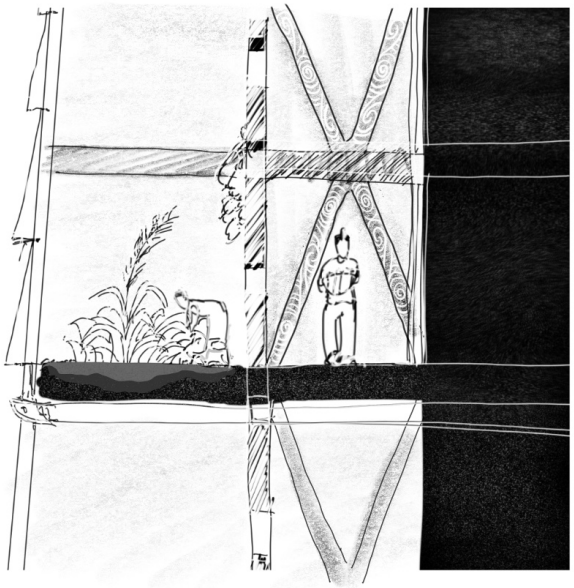


Figure – 35 Green Band (2021), Mixed Media

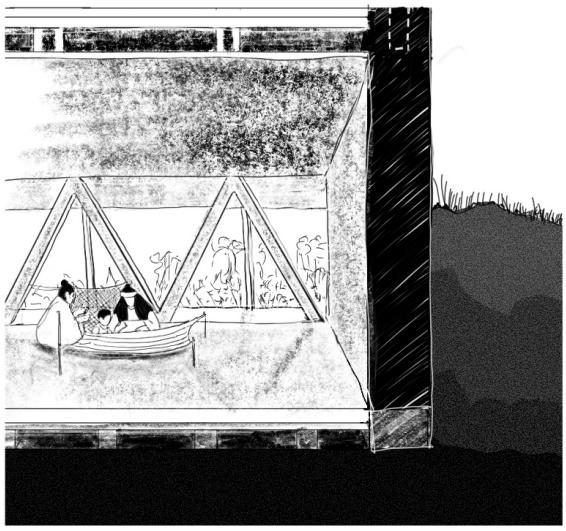


Figure – 36 Papa (2021), Mixed Media

Modeling Co-occupancy

Model making was also used as an expression of themes and notions. Modelling greatly supported capturing notions of Rangi and Papa, sky, and ground, above and below, two opposites together as one. Being able to express this through modelling with materials that can speak to these notions but also capture physical attributes desired for the project. Timber is the main material used because of its light weight potential but also the opportunities it has with traditional crafts and new technology. Timber framing was explored to see possibilities of modular forms and lightweight structures to inform the design decisions. Model making also helped explore tectonic opportunities in how the structures can act and work with elements of nature like diagrid details, roofing structures for rain catchments, fog catchments, shelter, shutters and green house structure, all of which supported the design process.

Figure – 37 Timber Frame (2021), Timber model

Figure – 38 Co-occupying textures (2021), mixed Timbers

Figure – 39 Outer shell (2021), Cardboard Model

Using modeling program Rhino helped manifest ideas without constraints, being able to express ideas through digital models helped solidify prior ambitions from the physical models and drawings. Rhino also assisted with exploring opportunities like using shadow to emphasize key elements of a model, especially framing work and creating diagrids, these forms of which were only made possible by Rhino software, thus strengthening the development process and project.

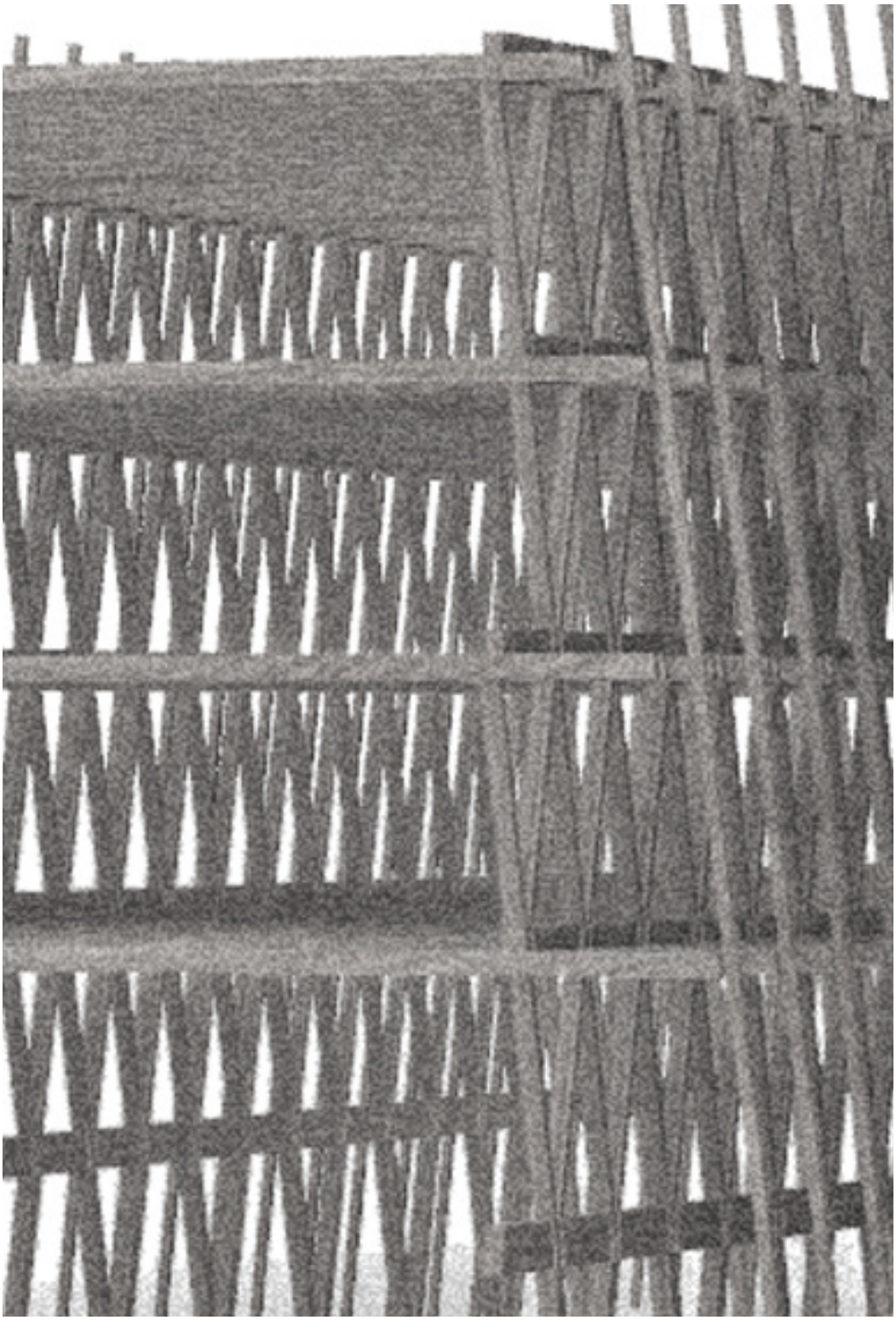


Figure – 40 Kōhī (2021), Digital Model

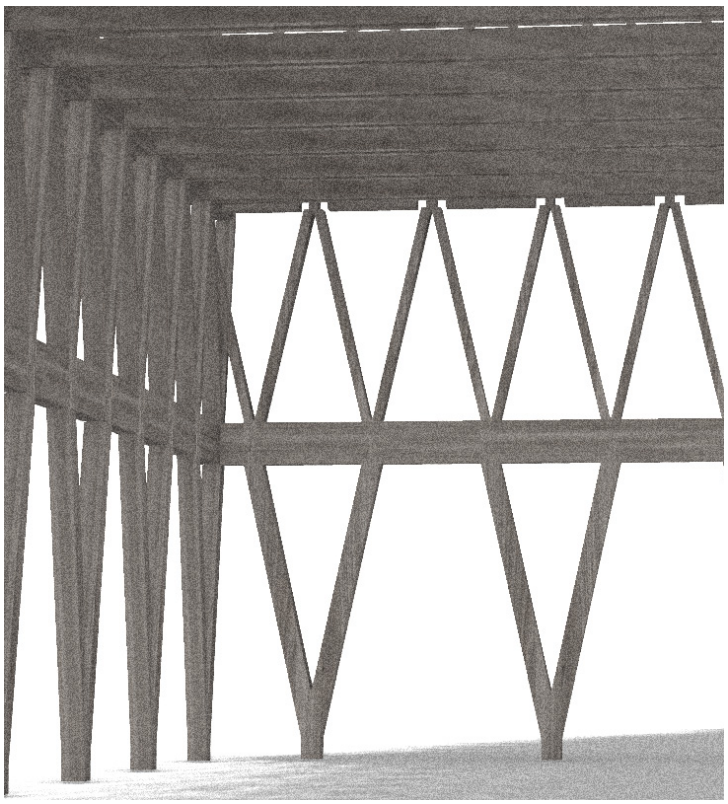


Figure – 41 Te Umu (2021), Digital Model

Programming Co-occupancy

Programming co-occupancy saw the process take relationships between elements of design as an integral part in the projects capacity to encourage co-occupancy. This process of programming looked to the relationships between occupants, buildings, and nature using this approach to inspire the drawing process and vice-versa. Programming for co-occupancy brought an element of detail, making the nature of micro elements just as important as the macro. This was expressed through drawing and parti diagrams to help visualise the project's intentions, possible relationships and prospects for the design and the site in general. This involved programming things such as the water cycle of the building, how people might interact with each other and nature and how the building speaks to its wider surroundings. All of the prior examples were maintained as key themes and possibilities for the site while working through this exploratory process.

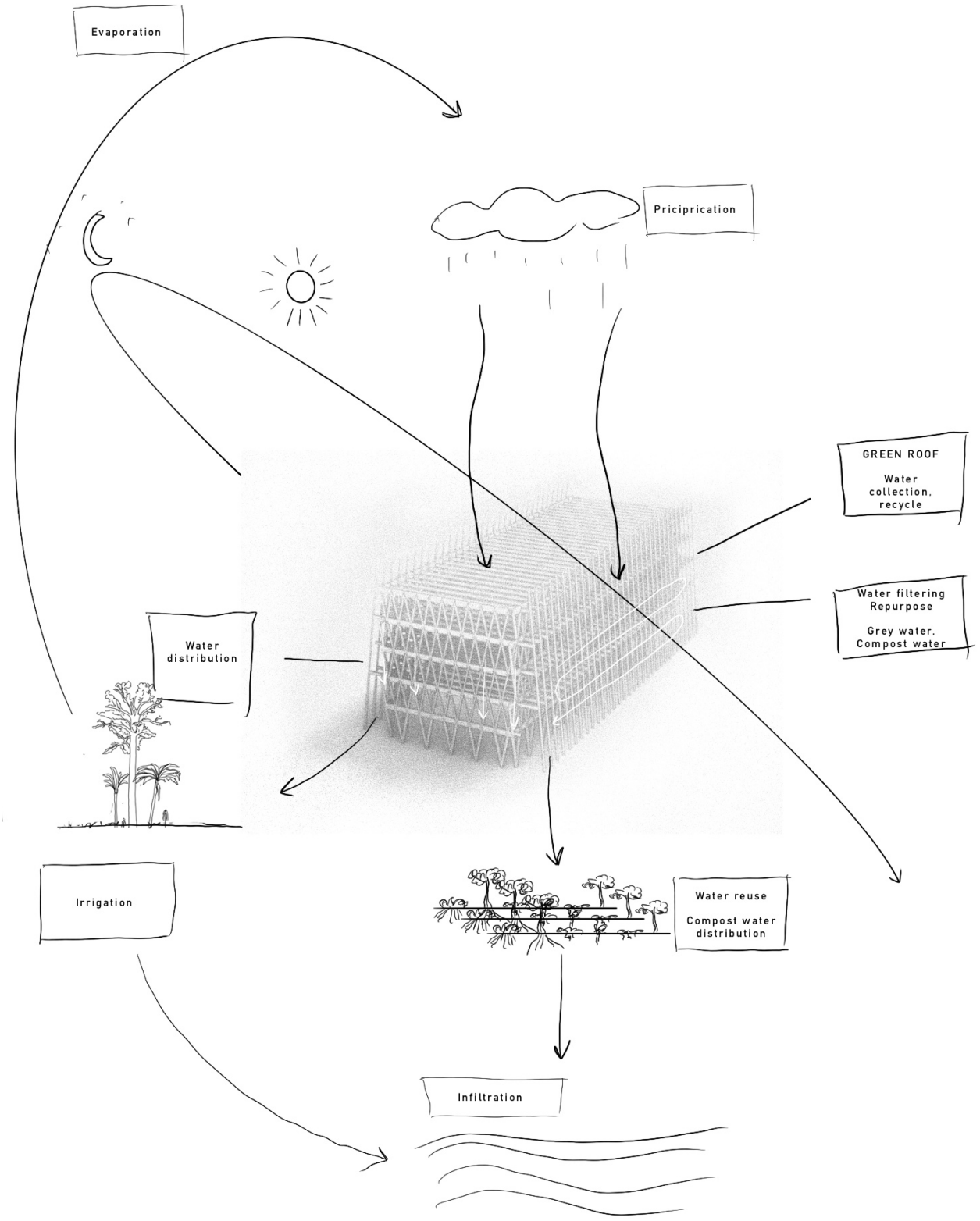
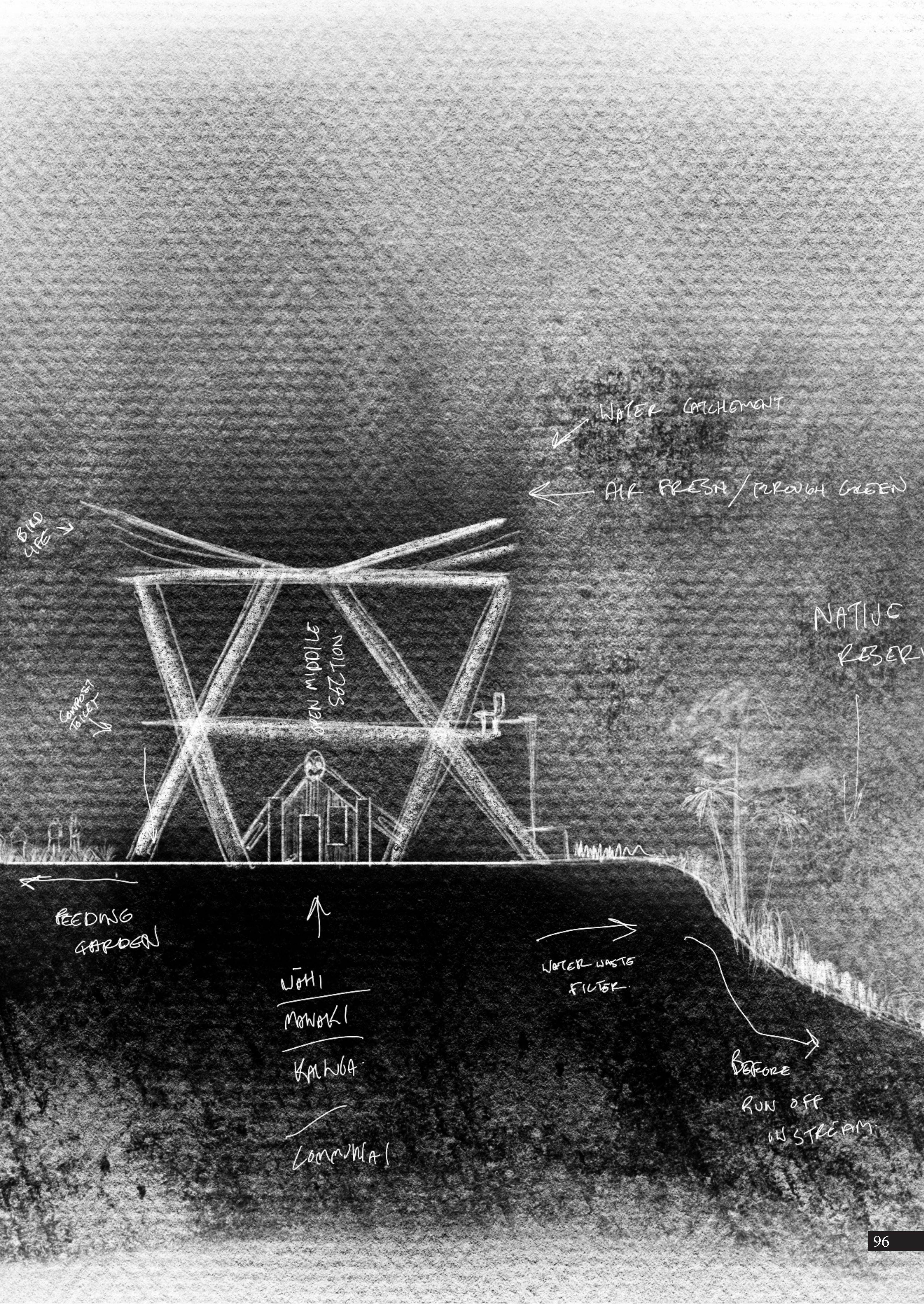


Figure – 43 Concept (2021), Digital Drawing

 Figure – 42 Co-occ (2021), Mix Media Diagram


WATER CATCHMENT
AIR FRESH / THROUGH GREEN
BIRD LIFE
OPEN MIDDLE SECTION
COMPOST TOILET
NATIVE
FEEDING GARDEN
WATER WASTE FILTER.
KAINGA
COMMUNAL
BEFORE RUN OFF IN STREAM.

Vertical Pā

Draft

The Vertical Pā was the draft outcome from the first phase of concept design, post physical modelling, rhino modelling and research, and was pivotal in solidifying the research direction moving forward. The Vertical Pā was a culmination of notions of co-occupancy with the environment, culture and the pursuit for a liveable Pā within a vertical setting. This stage also attempts to visually and architecturally manifest the early research concepts into a structural form. This Vertical Pā brings forth the notions of Rangi and Papa by providing spaces that interact with the two entities through materiality, inhabitation, and action. The design is an inverse connection from Papa to Rangi with the structure enabling access up and down, not only for people but environmental elements. The roof is imagined to act as a permeable water filtration system that interacts with rain and fog that is then recycled and filtered through to the living units, then treated and expanded throughout the Pā vegetation crops and māra kai before filtering into our water ways. The Pā also had shared, communal spaces, wharekai, wānanga space and community purposed areas that were imagined to be either public stalls or host food markets, enabling the gathering and social interaction between communities within and those living outside Pā. thus, creating an inter relational connection through a quintessential Pā environment. The design elements are timber forms and framing sitting on a hempcrete base to eventuate lightness of Ranginui and dense strength of Papatūānuku, while materials remain environmentally friendly. The Vertical Pā established the foundational components and was the first take-off point in the journey for the rest of my research towards creating a model that visually captured the possibilities of occupying space between Ranginui and Papatūānuku and how truly co-occupying space with our environment may function.

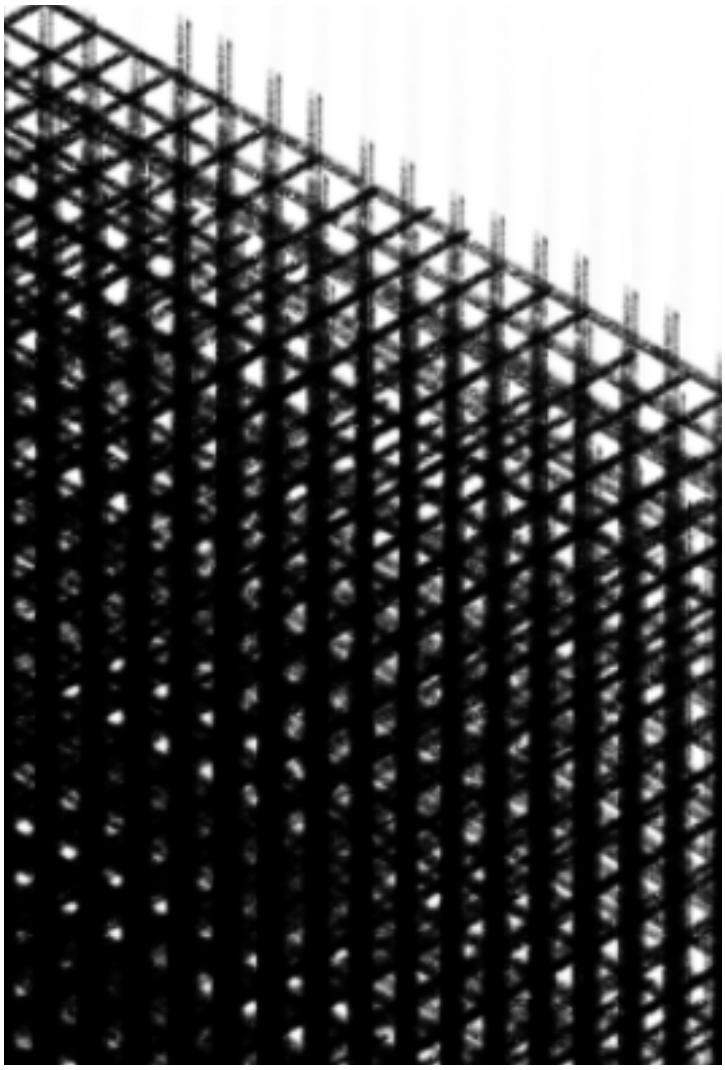


Figure – 44 Intertwine (2021), Pencil to Paper

Figure – 45 Hāpori (2021), Mixed Meda

Figure – 46 Vertical Pā (2021), Mixed Media

Living Environment

Draft

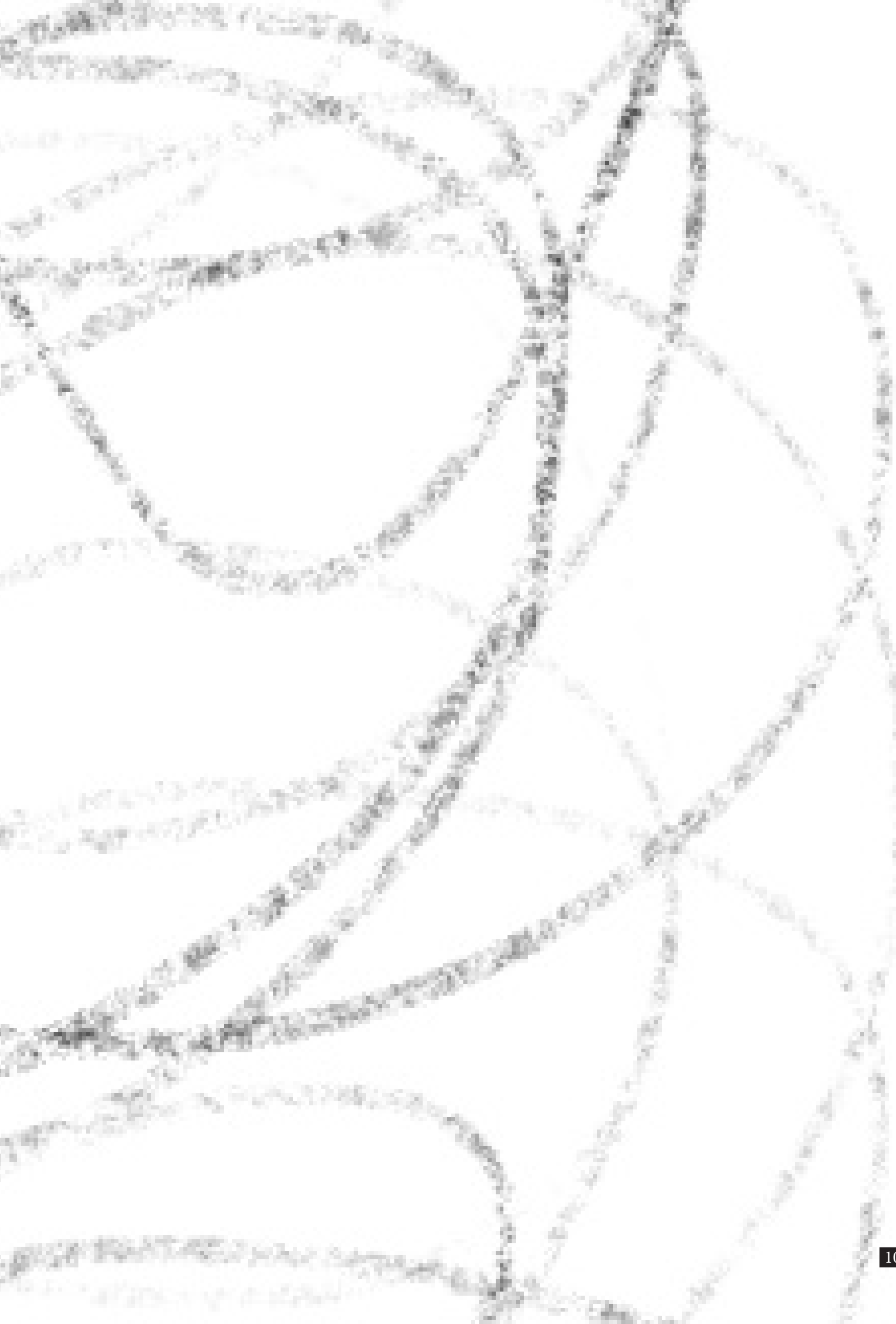
Like the Vertical Pā the Living Environment design holds on to the foundational notions of this research of connections to Ranginui, Papatūānuku and co-occupancy, yet with a more developed design and cultural grounding. The design alters its use of timber framing by looking at modular systems shaping the living environments and allowing room for growth and change. The design speaks to all the previous elements of water catchment and recycling, while now having a living system within the design itself that connects the inside to the out. The Living Environment is inspired by intergenerational and communal living with semi-private and public spaces which are able to be shared. Its structure is inspired by narratives pertaining to wharenui and traditional Māori housing. Working with features of wharenui such as the poutokomanawa depicted by the vertical shaft connecting Papa to Rangi, and the entry of the building acts as the whatitoka (doorway) of the whare.

The design along with its structure development saw the project take more of an environmentally based approach with added interest for interaction with the natural resources surrounding the structure. So much so, the environment became an equal part to the design and imbedded in the imaged process for the timeline and multi-generational approach to the project. Thus, introducing a reforestation approach that runs alongside the project development stages if not preceding the structure. The approach was brought to the forefront from the project needing to provide paralleled opportunity for the environment to prosper, with the idea to reposition the emphasis of the project to become something more than a structure but to serve the taiao itself and rightfully so. This gave greater purpose to the approach of co-occupancy needed between humans, non-humans and the wider ecology. With this reforestation approach introduced, it brings the project a sense of time and history, bringing back native trees in the attempt of recreating natural habitats that enable native flora and fauna to prosper. This also will provide learning experiences for Te Arawa to create a stronger sense of connection with taiao while providing climate benefits by producing cleaner air and rearing cohesive communities with shared aspirations to work together with our more-than-human entities.

Figure – 47 Kea (2021), Mixed Media

Figure – 48 Nohoanga (2021), Mixed media

Figure – 49 Birds eye view (2021), Mixed Media



Designing for Ranginui

Designing a Rangnui element for the pā is more than attempting to represent Ranginui himself. It is capturing the elements and implications that reside or come from Rangi to then influence or impact the design. Bringing the inclusion of Tāwhirimatea, god of the weather, winds and storms into the element of Rangi demonstrates a range of its components because Tawhirimatea lives through elements such as ua (rain), kohu (mist) and kapua (clouds) (Macfarlane, A. H. 2006).

Looking to the roof elements as activations such as a water catchment design for rain and mist, are options that can be explored when interacting with Rangi and Tāwhiri. This can be perfect for a place such as Rotorua where mist, fog and rain are common in the area. Opportunities such as green roof design are also possible for the design. Green roof elements bring both water filtering systems and greenery to the project, creating a more interactive space on the roof, and providing benefits such as reducing greenhouse gas emissions (Cascone, S. 2019). When one thinks about the sky we think light, space, cool, open. For Māori there is also knowledge, history and guidance. For Māori, the sky is also a place where they store knowledge and history. These are interacted with rituals that require the reading of the sky, sun, moon and stars. Implementing a design that can provide opportunities for wānanga (gatherings/deliberations) on kaupapa such as maramataka, karakia, waiata, kōrero can be beneficial and innovative for the communities within the Pā.

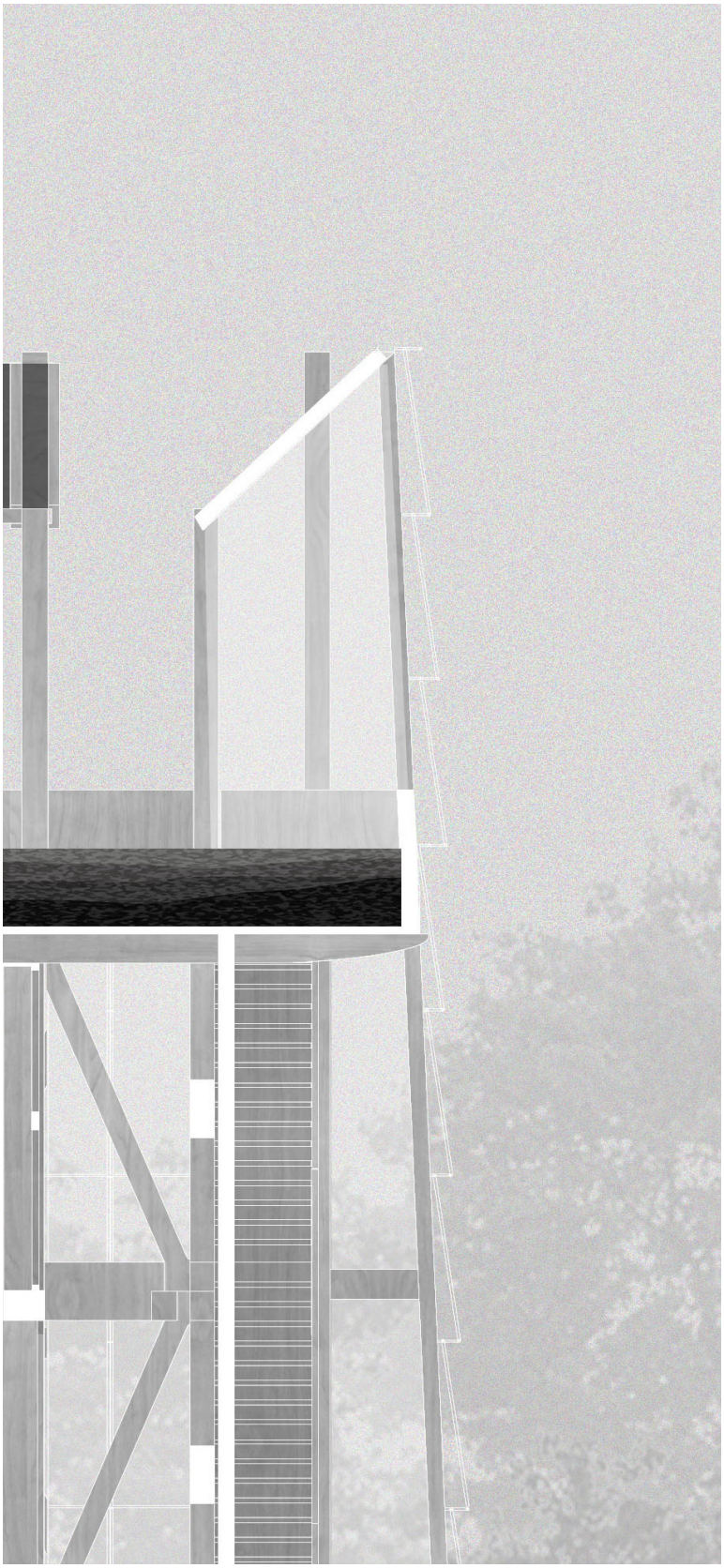


Figure – 50 Sky Setail Section (2021), Mixed media

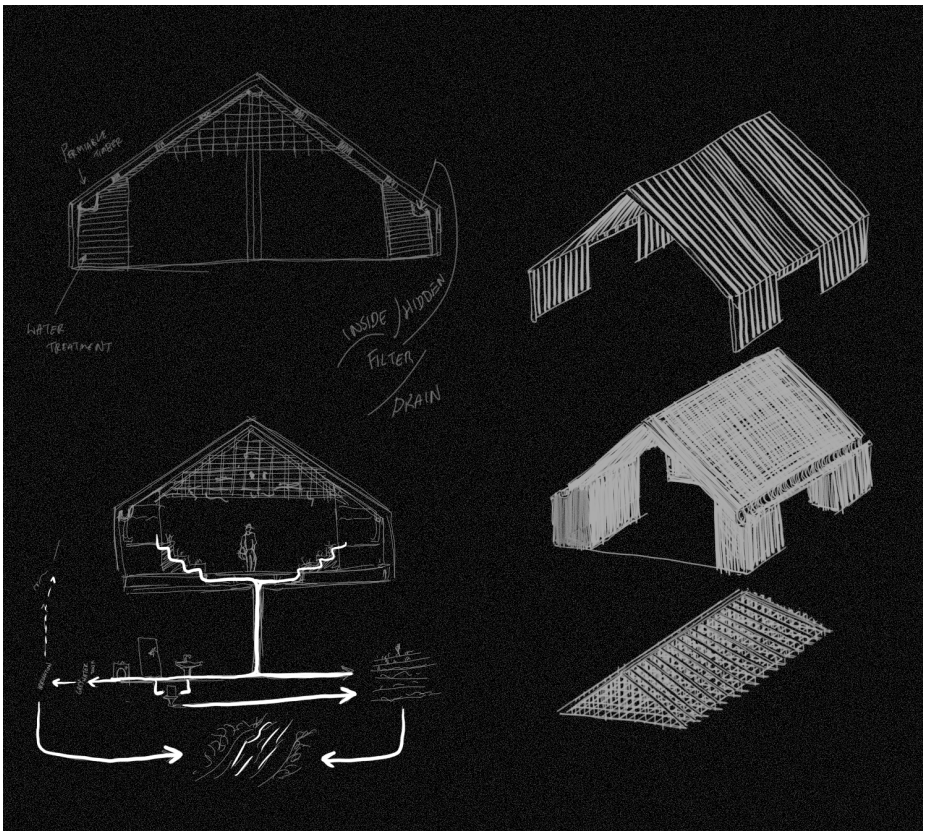


Figure – 51 Concept for Rangi: Filter (2021), Mixed Media

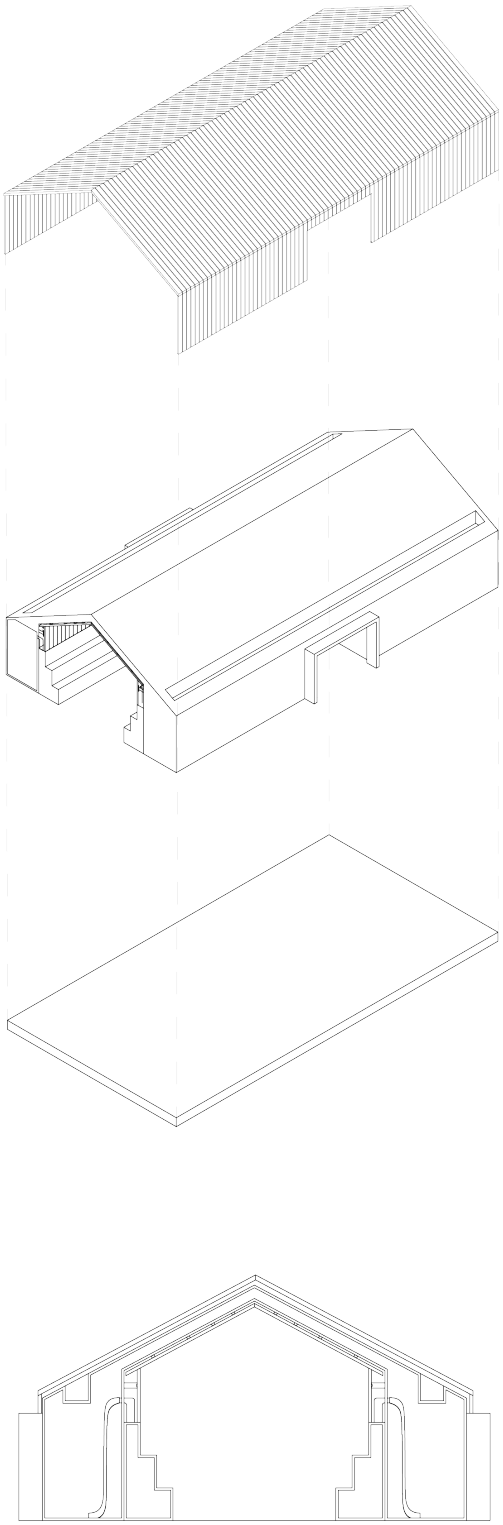


Figure – 52 Axo Rang: Filter (2021), Mixed Media

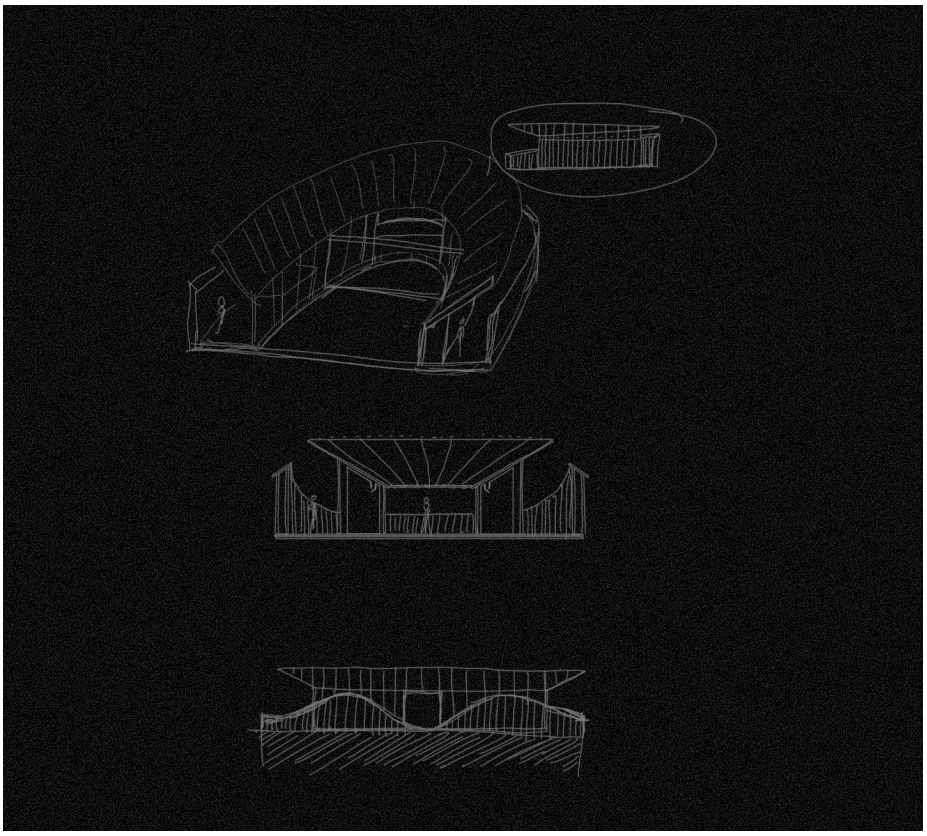


Figure – 53 Concept Rangi: Open (2021), Mixed Media

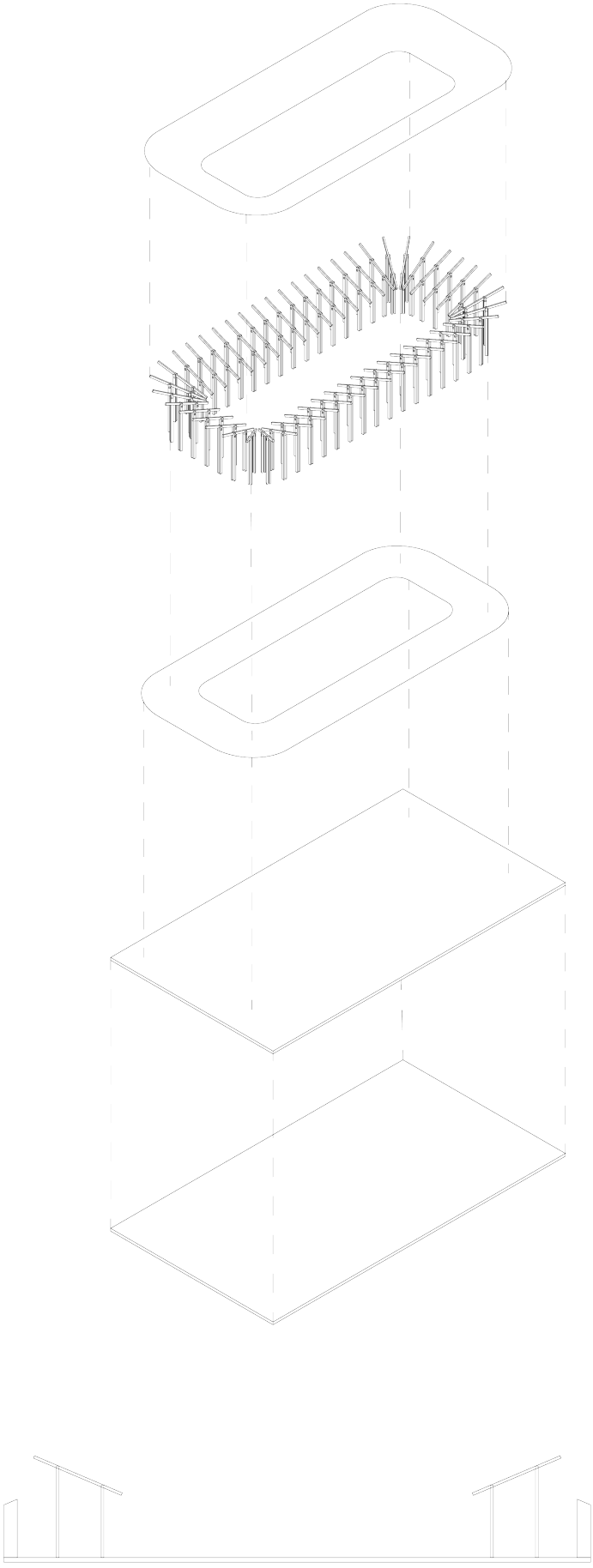


Figure – 54 Axo Rangi: Open (2021), Mixed Media

Designing for Papatuānuku

Working with whenua is a delicate matter for Māori depending on the occasion and the site. It is not to say working with Papatūānuku is an unseen practice for Māori. Examples of earthwork dates back to the early Māori settlements with the likes of palisaded fortified villages found on hills and peaks (M. J., Kolb & B., Dixon, 2002). There was use of earthwork for whare as well, which found houses dug into the ground for protection from the weather and to retain warmth in cold and trying times (Bulmer, S. 1994). Even when we think about celebrations, working with whenua is a huge part, as demonstrated with the gathering of kai for the Māori practice of Hāngi. There are many other examples that can be drawn from but it is important to consider that there can be tapu (sacred) connotations when working with whenua with the likes of urupa.

The site for this project is not considered to be tapu, but it is important to acknowledge these aspects for Māori when working with them on the development of whenua. Designing for Papa for the papakāinga is seen in many ways in the design, especially when thinking about repurposing excess ground in the development. Taking inspiration from old traditional whare and villages, and moulding and shaping whenua, means it can be interacted with as mounds or hills with in the area. When we think about Papa, she is the opposite of Ranginui. With whenua we see density and strength being key elements to consider when thinking about the material seen on ground level. Bringing dense material such concrete and cement elements can create a solid base and foundation. With that in mind, innovative biodegradable materials such as hempcrete would be able to provide that density and over time, if it was necessary the material can be broken down back to our soil. It is also important to explore the notions and activities that take place when on our whenua, things such as warmth, comfort, kai, mahi māra, kōrero, are all key themes that can influence the shape and design when being inspired by Papatūānuku.

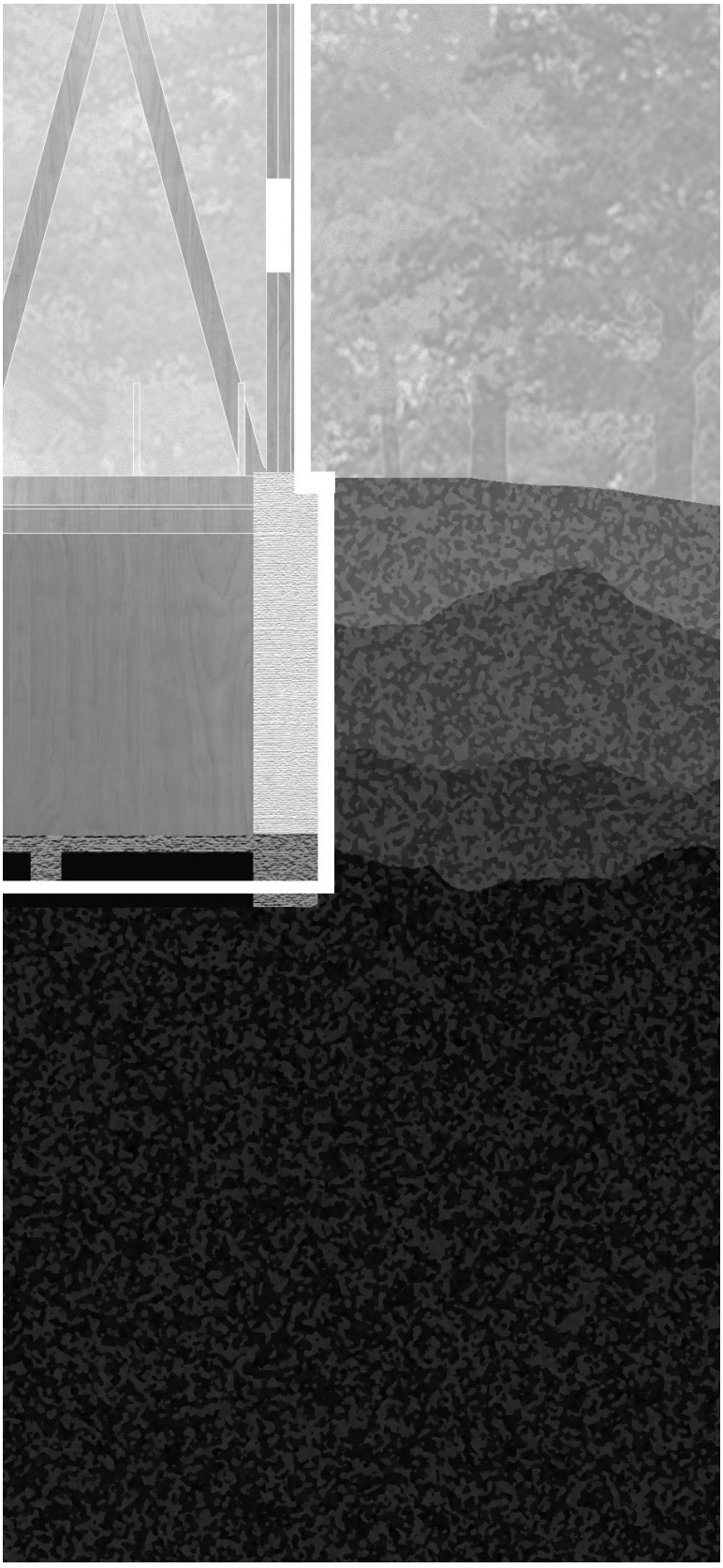


Figure – 55 Earth Detail section (2021), Mixed Media

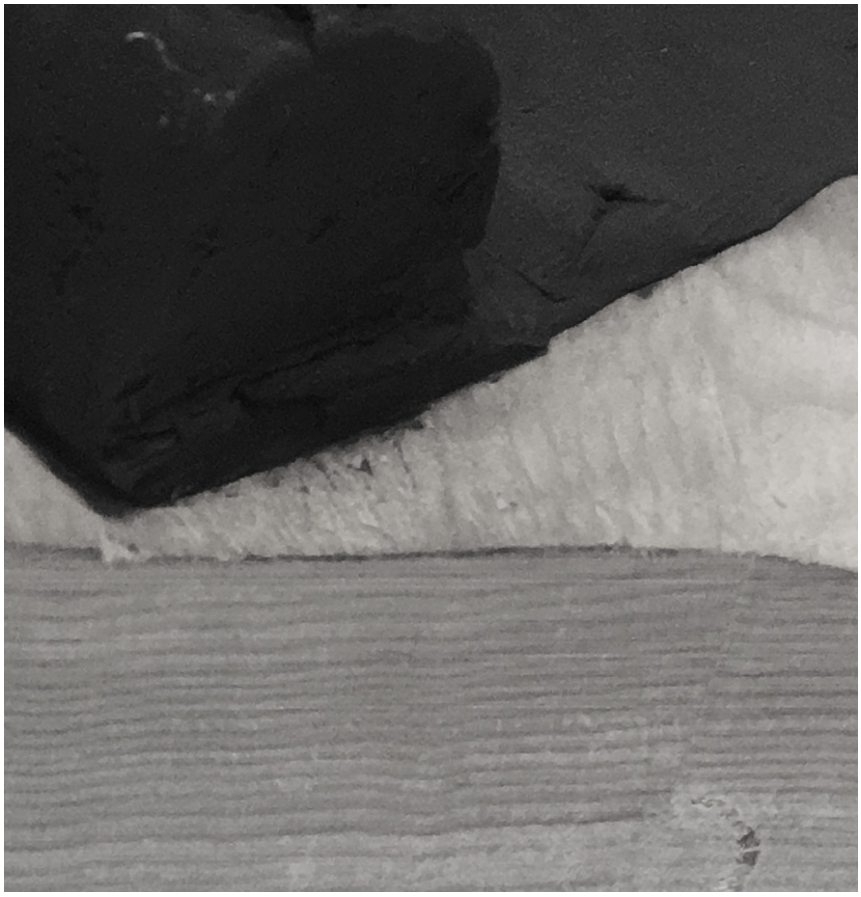


Figure – 56 Density Model (2021), Rimu and Black Clay

Figure – 57 Hauhake (2021), Mixed Media

Reforesting

The Wharenui Rise section is currently occupied by dairy farming industries with the whenua cleared of most of its ngahere. As expressed from the images above, the soil type present within the site offer opportunities for harvesting crops and repopulation of nature. This encouraged a redirection toward a reforestation regeneration approach to reintroduce native ngahere back to the area. The idea of repopulating the site with ecological systems is another ode to co-occupancy. Using the reforestation processes as the foundation, connects the Pā to its concept of co-occupancy and sets an example to how the project might grow as a design but also through its environment and community. This chapter finishes with a possible timeline exploration of the project from inception, starting from reforestation efforts to the materialisation of the Pā and beyond.

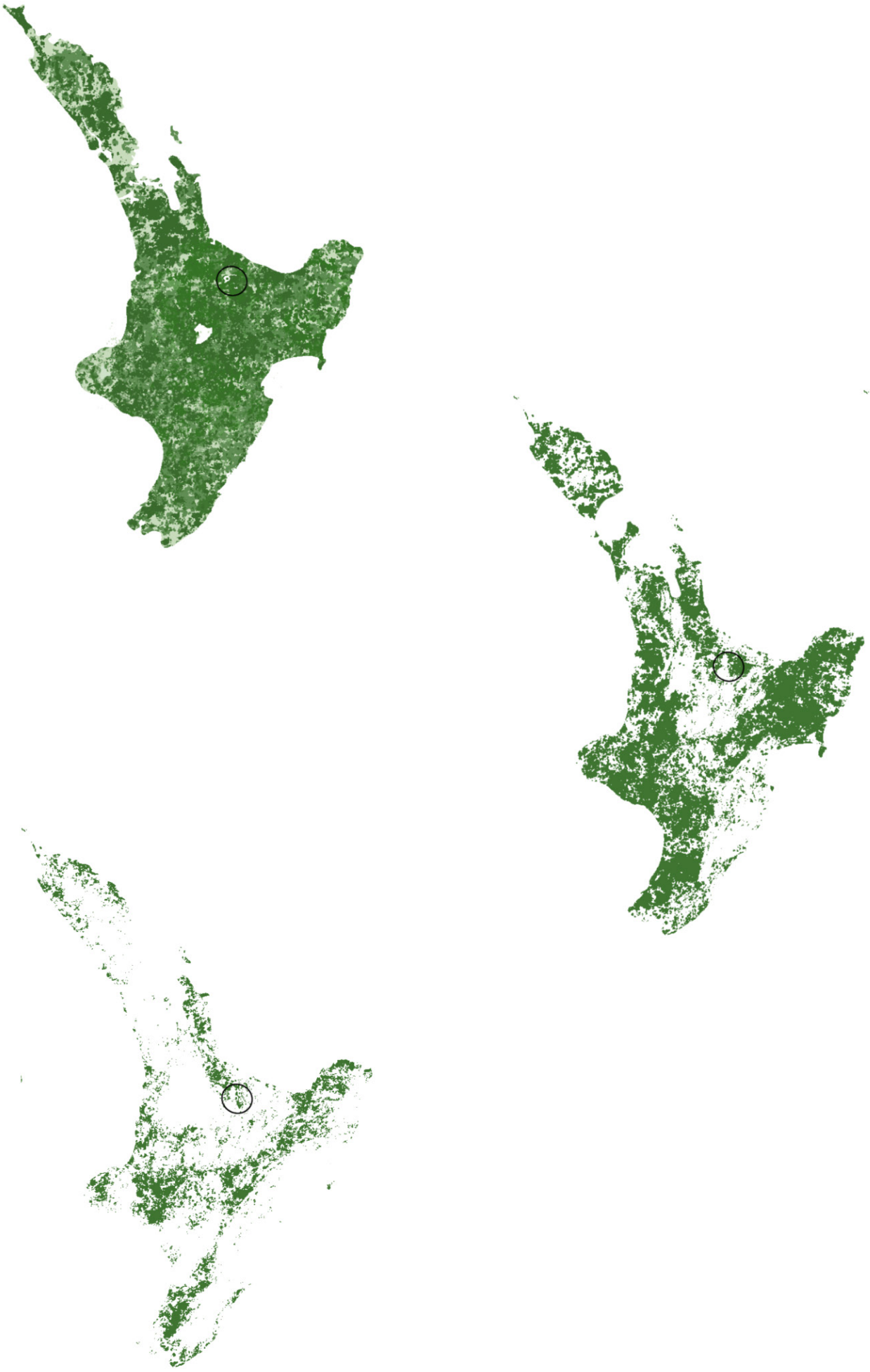
Seeing time as an element of the project brings a different perspective to the growth to bring life to the Pā. This gives even more reason to the methodologies of building for disassembly. A life cycle for the project and using the life as a tool within the design process relates to the future aspirations of Te Arawa. This positioning pushes the boundaries on how we design a co-occupying community, and what will that community look like 100 years from now.

Figure – 58 Taiao, Digital Photograph

Ngahere

Pre-civilisation here in Aotearoa, forests covered over 80% of the land, thriving in native ecology of flora and fauna. When Māori arrived and settled across the North and South Islands, some forests were burnt and cleared to begin settlements and build fortified Pā mainly on the coastlines of Aotearoa and Te Wai Pounamu. From the arrival of Captain Cook in 1769 until the 1840s, six point seven million hectares of ngahere had been replaced by grass and fern fields, changing the natural landscape. From 1840 another eight million hectares were cleared and by the 2000s, Aotearoa only had six point 2 million hectares of ngahere. The forest degeneration trajectory as it stands is dangerous and more must be done to replant native forests and regenerate the natural eco-system.

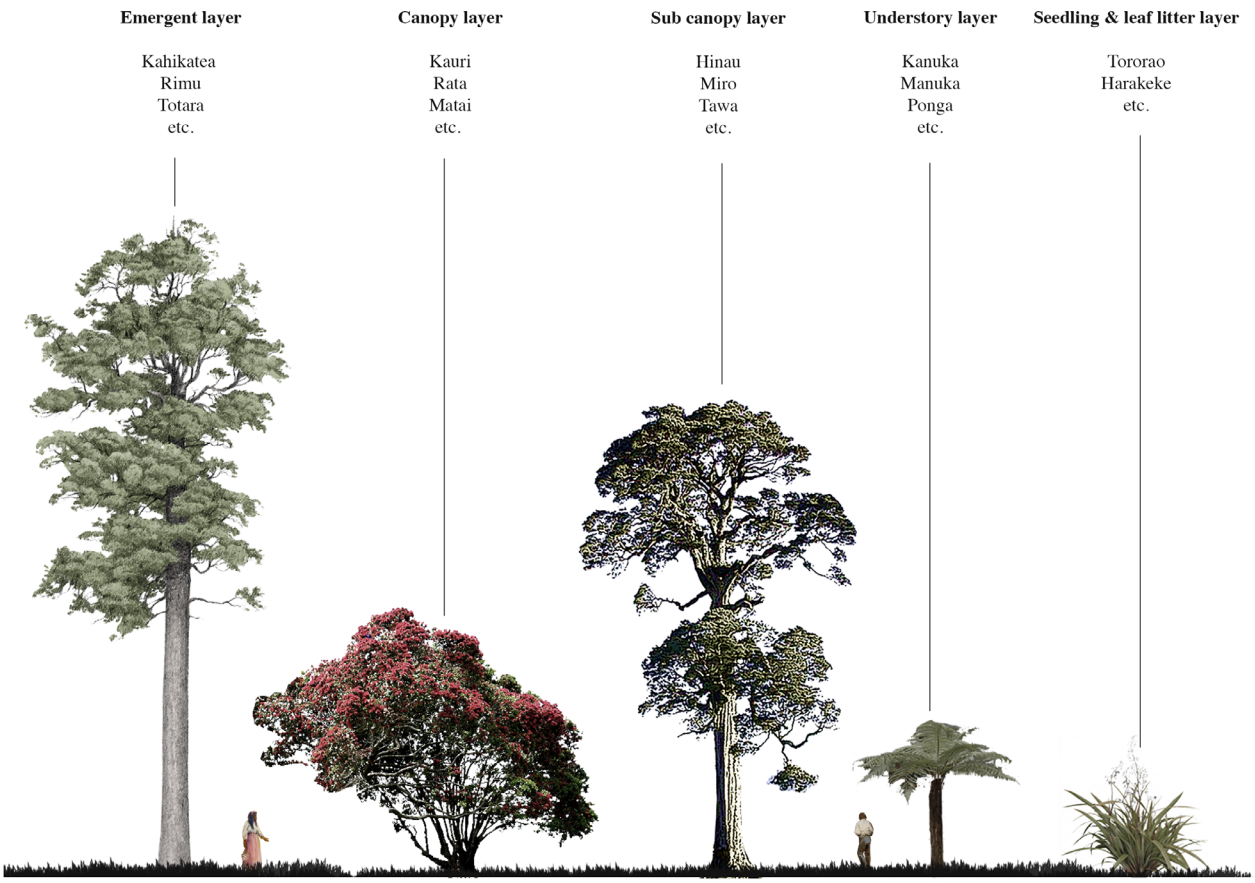
Figure – 59 Ngahere Degeneration (2021), Mixed media



Native ecology

Planting trees improves the productivity of land and can increase soil retentions on steep slopes. Trees can also provide biodiversity and wildlife habitats which reduce climate change by absorbing carbon dioxide and fight the current climate war. More importantly planting trees does not only protect the environment but also create job opportunities, which is essential for rural and forest lying communities like Rotorua, Kaingaroa and within the Te Urewera Ranges. The ideal situation would be to regenerate native forests with flora and fauna including Kauri, Rimu, Tawa, Matai, Rata, Rauponga and Harakeke. With the ngahere comes the abundant fruits born from the trees and leaves that support larger bird life such as Tūi, Kākā and Kea. The ecology of natural habitats brings the added interaction people can have with non-human species in an everyday situation, bringing health benefits through environmental connection physically, mentally, and spiritually.

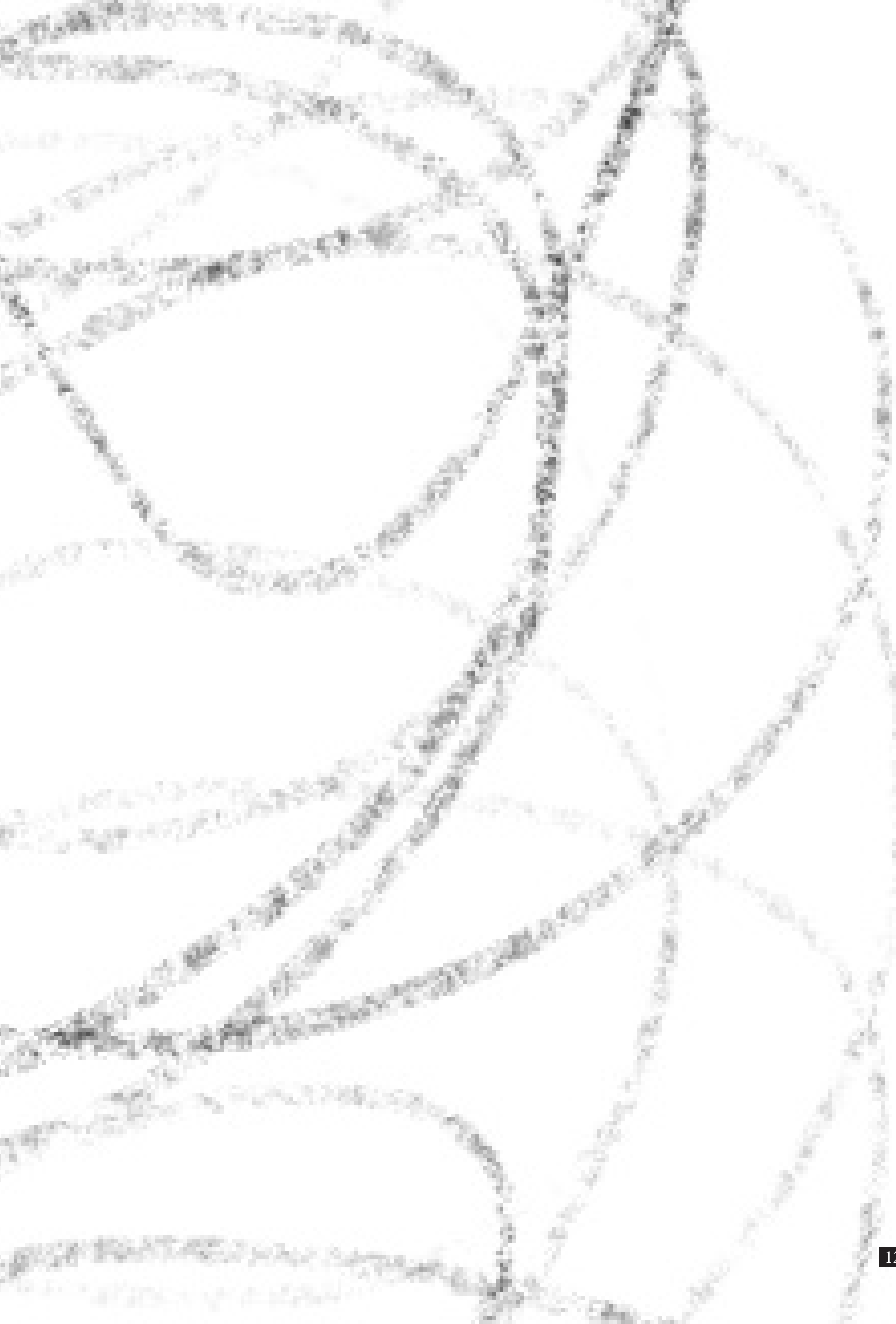
Figure – 60 Native Flora (2021), Mixed Media


Emergent layer
Kahikatea
Rimu
Totara
etc.
Canopy layer
Kauri
Rata
Matai
etc.
Sub canopy layer
Hinau
Miro
Tawa
etc.
Understory layer
Kanuka
Manuka
Ponga
etc.
Seedling & leaf litter layer
Tororao
Harakeke
etc.

Taiao/Kainga

For the Pā to fully thrive with the reforesting approach is to include the process of planting as a part of the steps within the development itself. Having the regeneration process alongside the infrastructure and community building. The planting approach that the Pā looks to follow is that of interplanting with a mixture of native trees and shrubs to reduce weed and improve establishment of timber species, but by doing this also enables an array of wildlife to inhabit the space. The duration of the growth can support the communities by providing job opportunities and infrastructure for the iwi and hapū of Ngāti Whakaue. Creating a community around the Pā that will be put in place, thus creating a Pā culture at the start of the project and into the future.

Figure – 61 Whakatō (2021), Mixed media



Living Pā

Final

The exegesis is now at the stage where it draws from all previous chapters to present Pā design approach. The Pā inception point starts long before the erection of the building. This is a 50-year cyclical project, starting with the regeneration of native forest, developing the current degraded native bush that is already present in the site area. This process will be a 100-year journey with regular informal hui every 5 years to assess the Pā as it grows while acknowledging the fact that the materials life span may only last 25 to 50 years. This also allowing the Pā to grow with the inevitability of evolution of technology and resources over time as well. This process will start with planting efforts put in place to regenerate some of the native plants and the added crops to start as resources for the iwi of Ngāti Whakaue. This will later be shared with the Pā that is to be built and assembled at the 15th year of the project to then be inevitably lived in and occupied. By the 50th year it is anticipated that the projects environment would have grown where we will see the final few buildings erected. By the 100th year, wānanga and kōrero will need to recommence on the topic of whether the Pā will need to be adapted, disassembled, or relocated depending on the issues and demands of the time.

The design is constructed to be assembled and easily adaptable depending on the need of the Pā. Spaces are crafted to enhance community and collaboration through generations while also being mindful of their surroundings. The Pā aims to co-occupy, to live in harmony with the ecological and sociocultural systems, by growing and evolving with its people and the environment. The Pā will be constructed by the materials sourced locally within the Waiariki area. Hemp will be planted and grown alongside the regenerating native bush and serve as to become hempcrete, the concrete substitute for the Pā foundations. The hempcrete will then be moulded to blocks for the structural walls of the architecture. The timber for the Pā will be sourced and fabricated from local forestry trade mills that hold partnerships with Ngāti Whakaue and Ngāti Pikiao. This supports the local business economy and creates and maintain relationships between the Pā and Rotorua infrastructure groups. The Pā will also utilise the innovative resources at Scion located at the Whakarewarewa Forest for the glulam beams. It is envisioned that the Pā will have responsibility to upkeep the whenua which it occupies, including the crops and native sanctuary that surrounds it.

Figure – 62 "Tirohanga ā Manu" Birds Eye view of Living Pā (2021), Mixed media

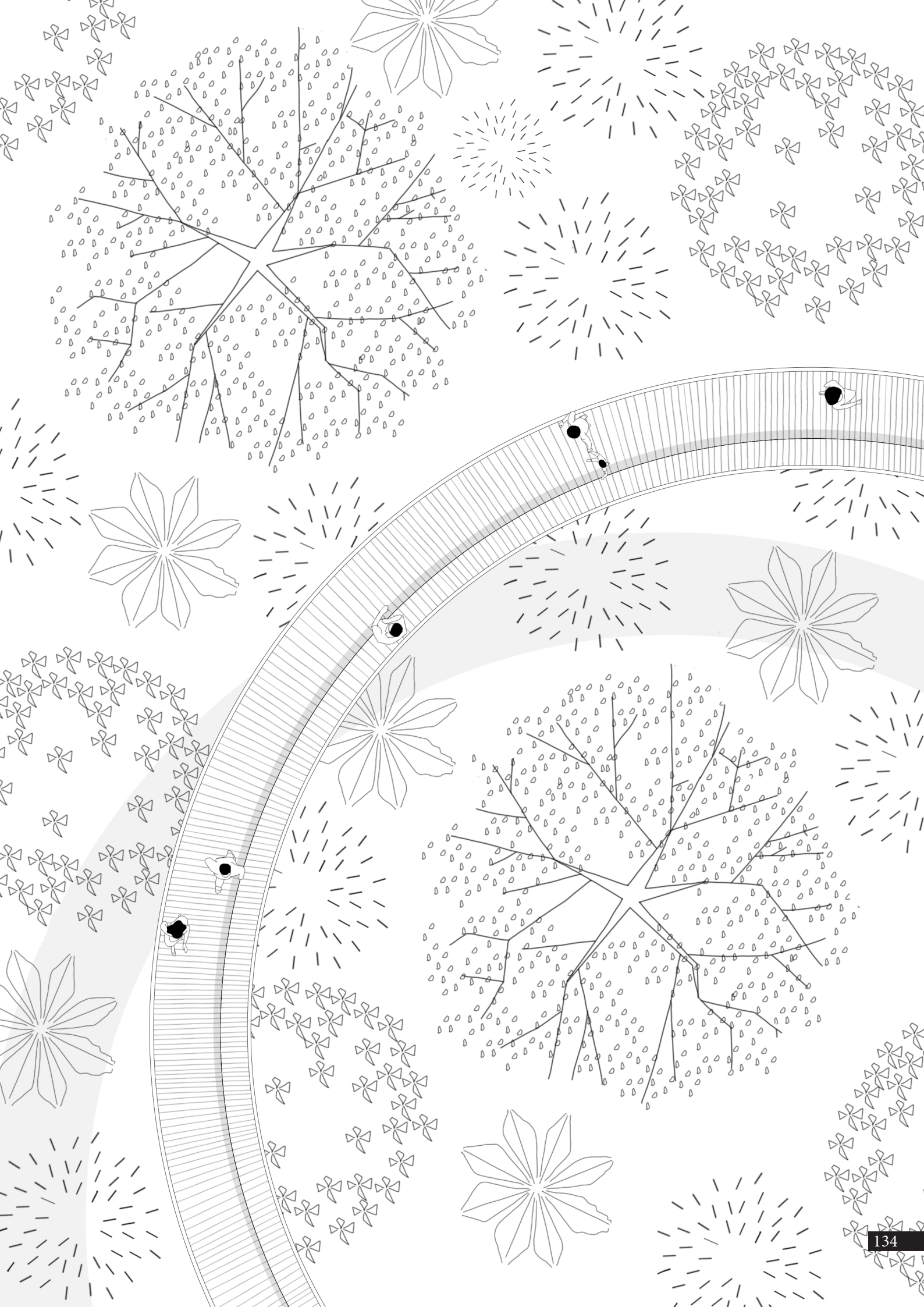
Figure – 63 "Te Karanga" Perspective view of The Call (2021), Mixed Media

Co-occupancy is embodied within the Pā through the opportunities for occupants to interact with other species, beings, elements and entities. The Pā design encourages interaction with the ngahere, the people, the sky and the whenua through moments within the Pā design which are expanded on below.

Co-occupying forest architecture

The ngahere finds its place in the Pā as a neighbour to the structures built, and a tuakana (elder) guiding the movements and growth of the Pā. The ngahere not only provides native bush to prosper and grow but also gives communities the opportunity to grow with it. It is important to be aware that the ground floor will be sensitive to the multiplying foot traffic over the years. So, bridges have been designed to keep occupants off ground, allowing the soil and ecological habitat to prosper and grow below. While bridges are connecting each Pā structure, they also provide the interaction between humans to native flora planted thus attracting more native fauna to the area as well.

Figure – 64 "Arawhiti" Plan view of Bridge (2021), Mixed Media



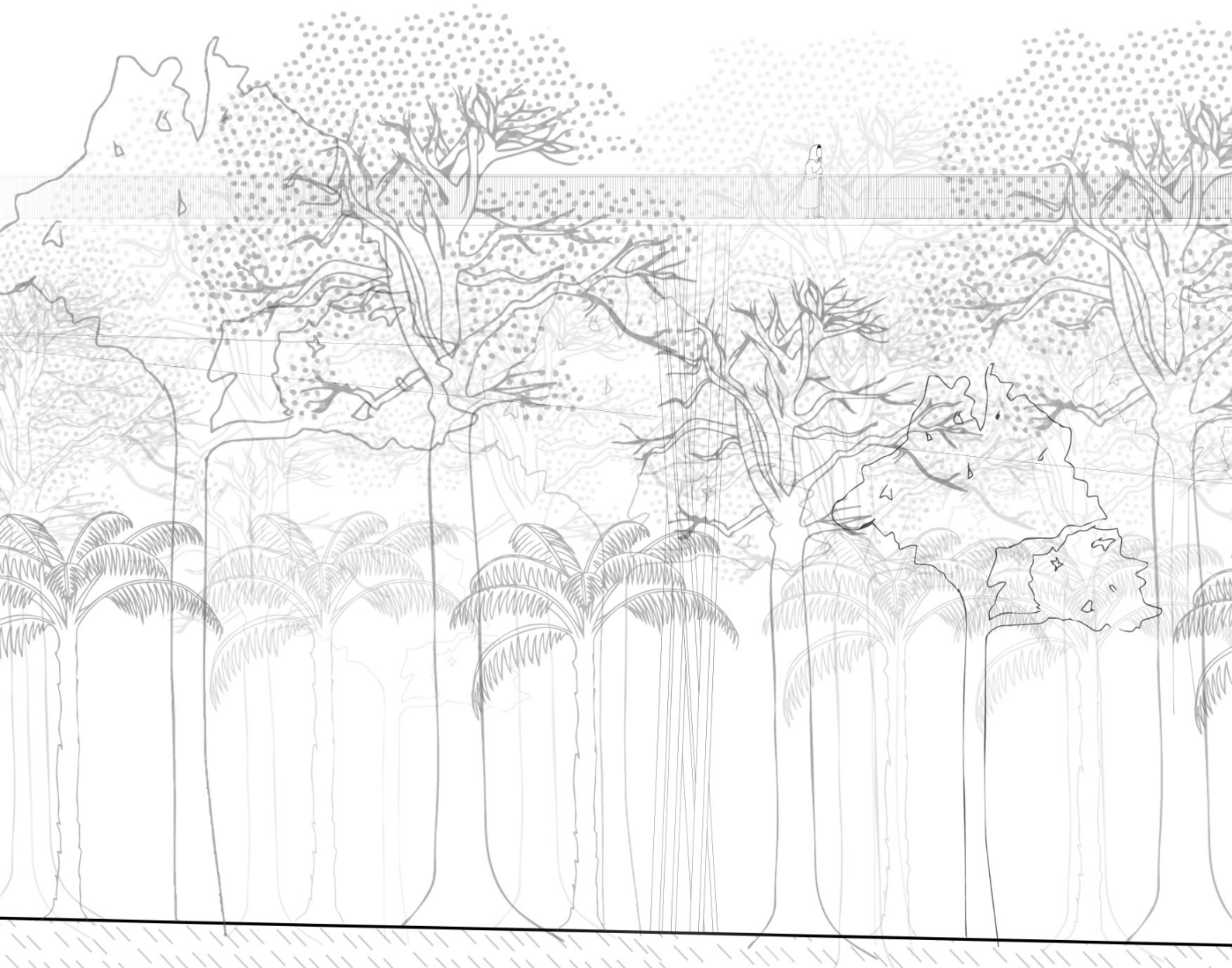


Figure – 65 "Te Ngahere" Section view of Bridge (2021), Mixed Media

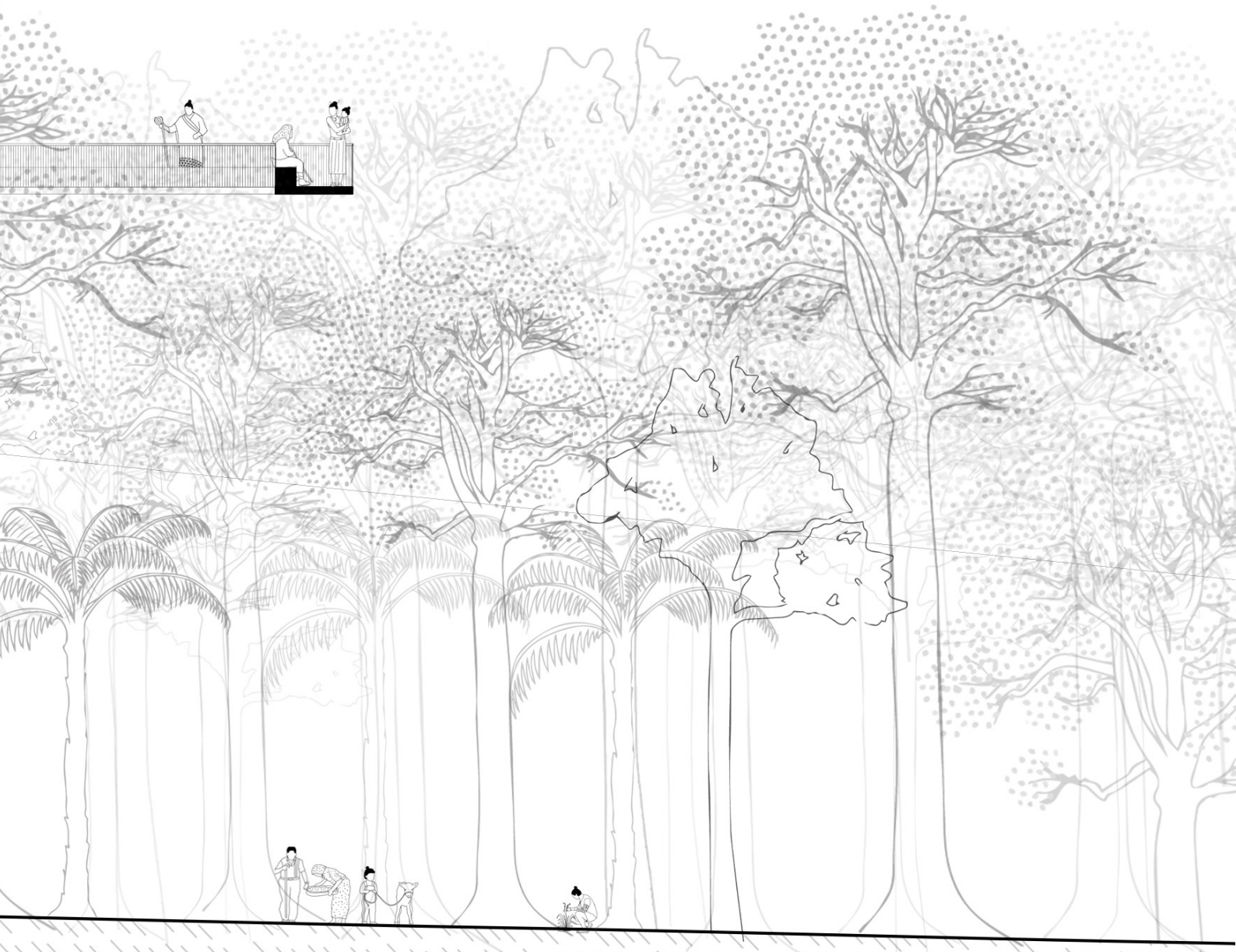
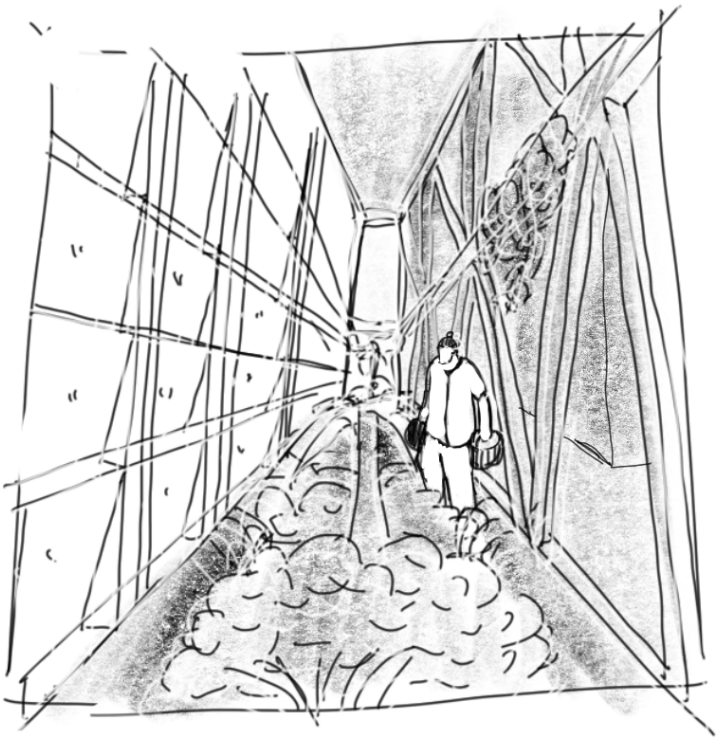


Figure – 66 "Hikoinga Taiao" Plan view of Bridge (2021), Mixed Media

Figure – 67 "Hononga ā Taiao" Perspective view looking up to Bridge (2021), Mixed Media


connection through bridges, being light on Papatuanuku
Living with the flora and fauna

The Pā structure interacts with its forest environment by living at tree level occupying space with manu in the trees while also providing shelter for the communities that care for the ngahere. Co-occupancy with ecological systems is seen within the architectures green section, allowing depth for planting and fecundity, accessing the rich volcanic soils in the area of Rotorua to be used as a part of the architecture for harvesting purposes. This green band also allows for secondary natural filtering systems for air other than the ngahere, providing fresher and cleaner air for the Pā and its occupants. This also provides an alternative approach to planting crops and resources for the Pā while in a vertical structure, keeping the use of whenua to a minimal and allowing the ngahere to grow without excessive interruptions. This cements a stronger possibility to the sustainability and health of the native plants and wider environment heading into the future.



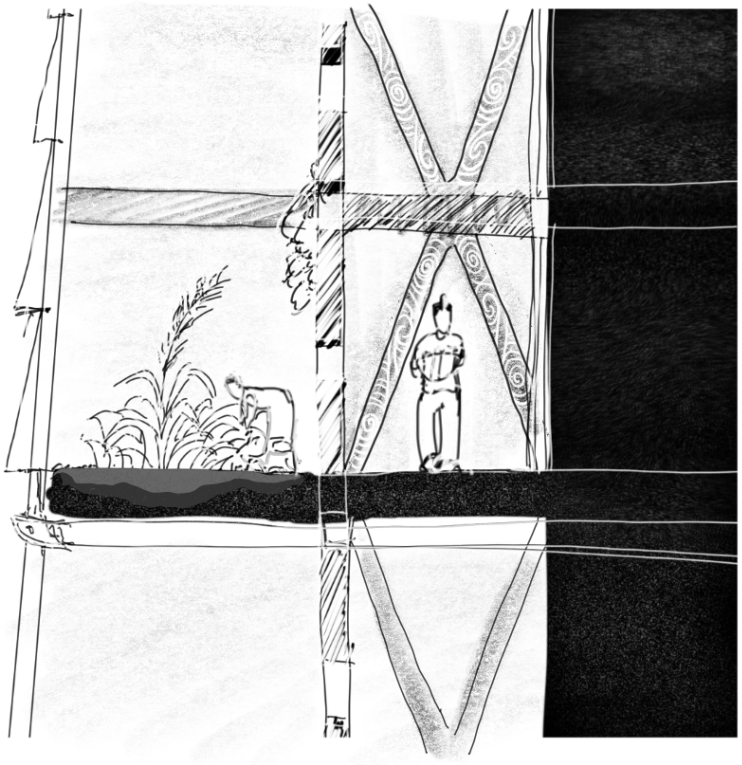


Figure – 68 "Mara a We" Perspective view of Green Band (2021), Mixed Media

Mara kai to bring whānau together

Co-occupy between families

Opportunities for families to co-occupy space together are provided with the shared balconies for kōrero, kai and sharing of resources. These balconies also branch onto the green band around the building allowing for shared māra kai and communal activities indoors. Shared facilities like the laundry area are located at ground level, with a wharekai for shared food and dining together at level one is provided within the Pā. Having a shared laundry not only provides the families the opportunity to wash and clean together, but it helps minimize the space used within the living units and allows water and grey water to be accessible and centralised within the one area.

Figure – 69 "Hākari" Perspective view within Wharekai (2021), Mixed Media

Figure – 70 "Hononga ā Whānau" Perspective view and ground level (2021), Mixed Media

Co-occupy with sky

The Pā co-occupies the sky by how it lives and interacts with the multitude of elements that descend from Rangi and his many children. This is seen within the buildings Rangi section of the Pā, acknowledging the drastic weather changes that are experienced in Rotorua, a green roof, drainage systems to catch rain and netting to catch fog. Water filters through the building to be recycled, then grey water and compostable water are distributed through re-use or holding tanks as well as irrigation systems for compost and crops. From there, the water passes through rainwater gardens, cleansing its way through channels before entering the Waingaehe awa and onto Lake Rotorua. The Pā occupies its space with the sky by also purposing a rooftop for whānau to preform rituals and events such as Maramataka observations, Matariki rituals and other activities concerned with the sky. This is important to keep the Pā community in sync with the natural environment around them, while retaining and passing down cultural traditions onto the future generations.

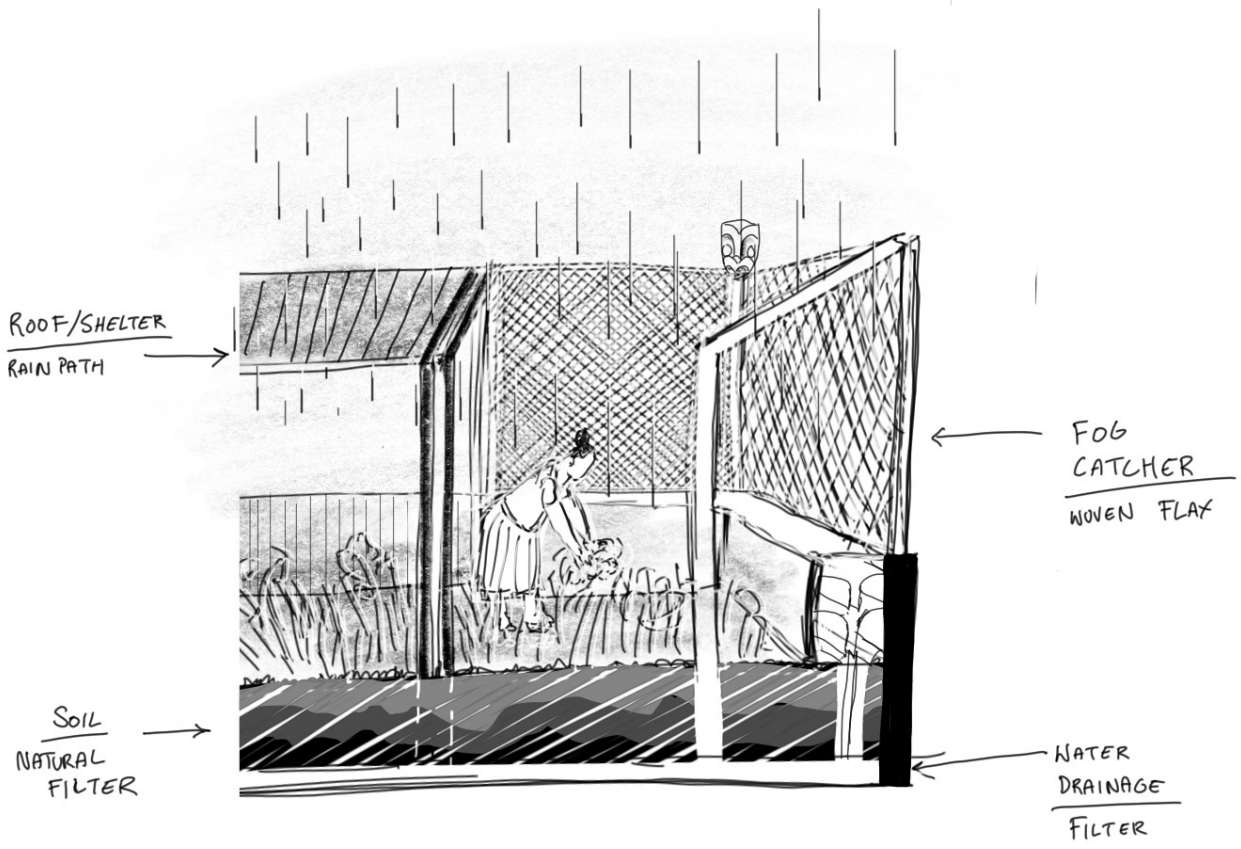

ROOF/SHELTER
RAIN PATH
FOG CATCHER
WOVEN FLAX
SOIL
NATURAL FILTER
WATER DRAINAGE
FILTER

Figure – 71 "Te Mara a Rangi" Perspective view of Ranginui Space (2021), Mixed Media


Fog catcher

Co-occupy with whenua

Whenua is the foundational layer of the Pā and is seen occupying the space in many forms, locally sourced aggregate and hempcrete bricks originally grown on the Pā are used within non-load baring areas. Volcanic soils from the site area will be distributed within the vegetation strip and green roof top of the Pā. The whenua that is also excavated is repurposed and moulded to be the ground floor walls, creating a hill for the Pā to rest on. This is interacted with by the occupants and guests as an entrance point both up and down and to ease the Pā visibility within the forest floor.

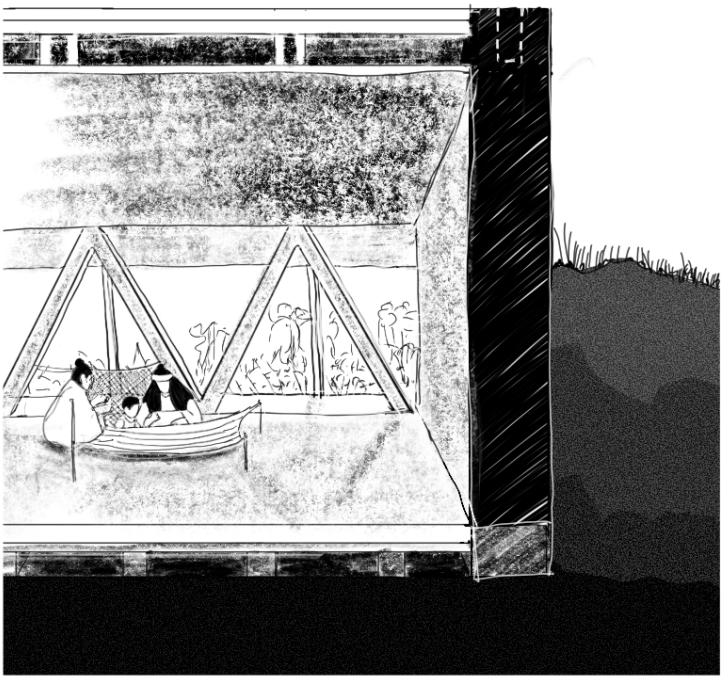
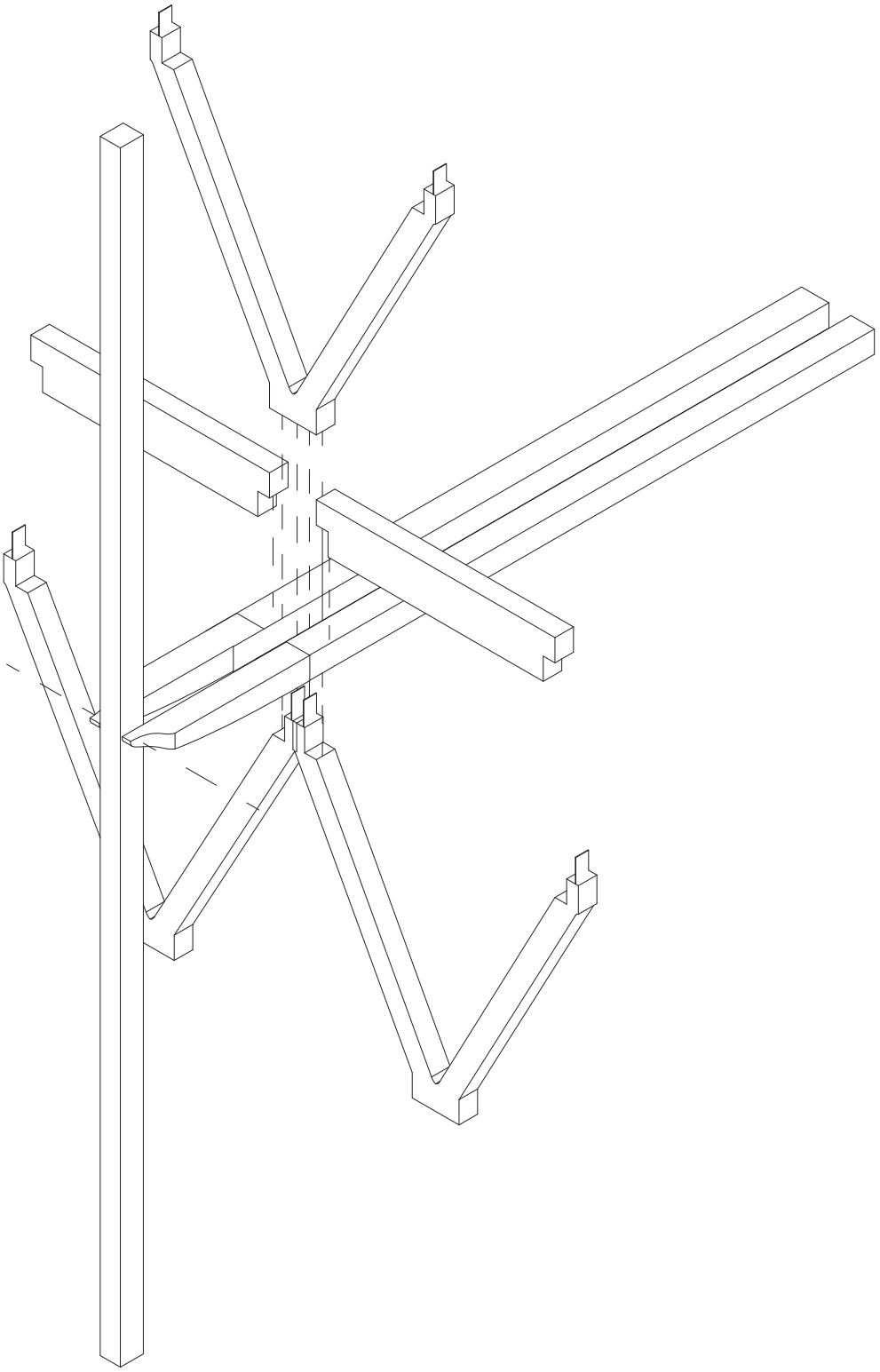


Figure – 72 "Te Māra ā Papa" Perspective view of Papatuanuku (2021), Mixed media

Diagrid

The building is a tapering vessel wrapped in a korowai that is defined by a double layered diagrid facade that carries all vertical loads in the building. The diagrid structure is a modular system that is inspired by the cutting edge engineered timber structure of the Scion Innovation Hub in Rotorua. The structural elements are constructed of laminated veneer lumber targeting to have a building that has no columns or load baring walls to maximise flexibility now and in to the future. This introduces the possibility of adaptation in the process together with the usage of the building to be open to change over time. The light-weight construction reduces the use of unnecessary materials and harnesses traditional techniques with advanced milling to produce elegant connection details. The connection type of the diagrid connects both above and below and the stiffening beams cantilever out as a continuous element to also support the outer faced but act as the green band support. The diagrid form pays reference to tukutuku panels seen as décor pieces in wharenui, each pertaining to their own stories and history.

Figure – 73 Axo Connection Detail (2021), Mixed Media



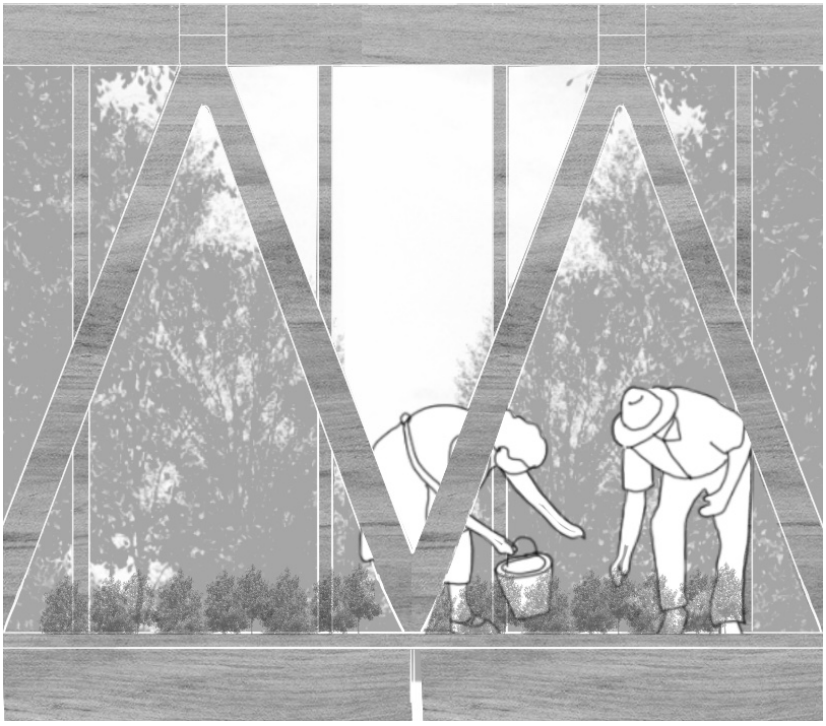
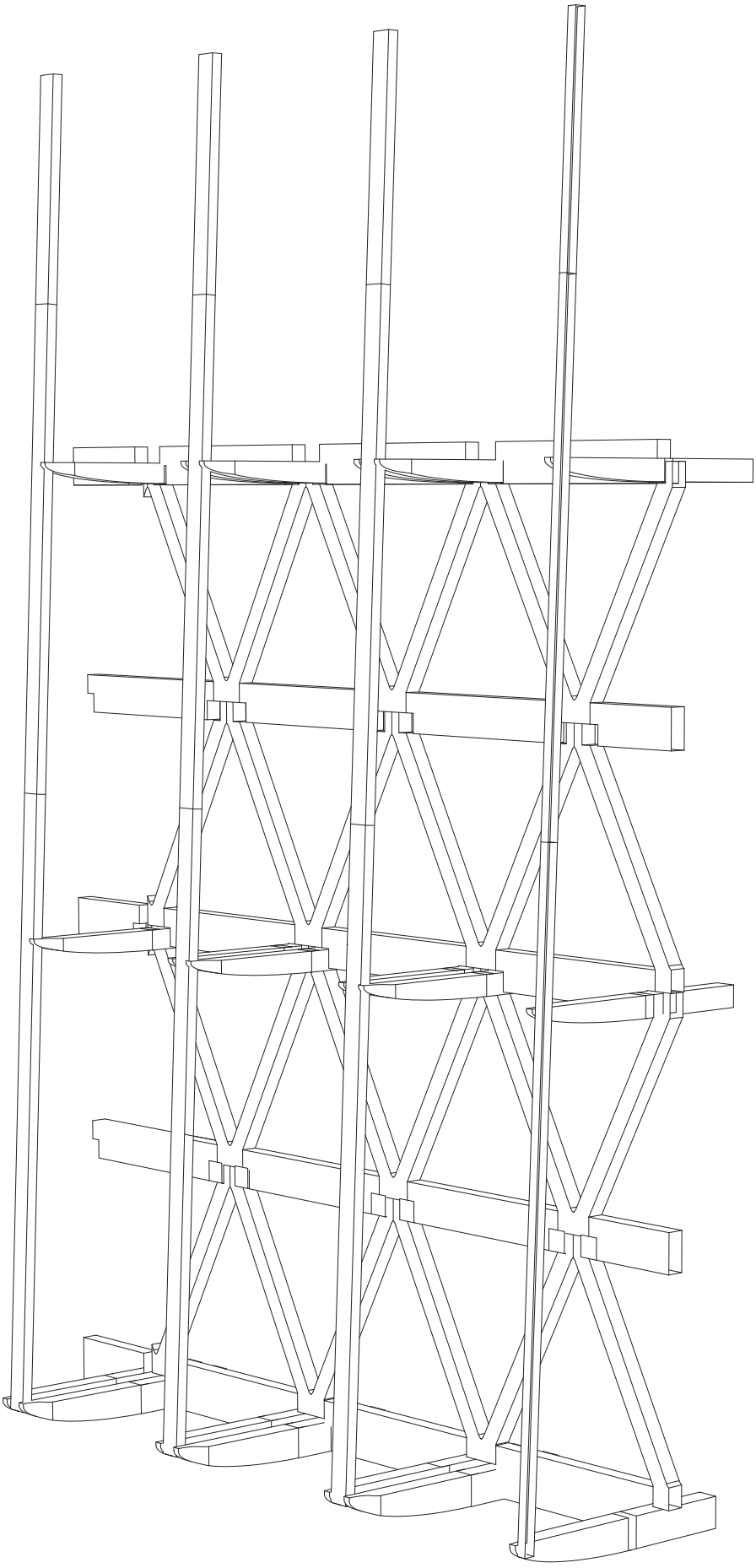


Figure – 74 Co-living (2021), Mixed Media

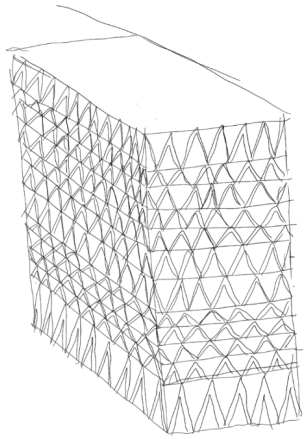
Figure – 75 Diagrid Structure (20210, Mixed Media

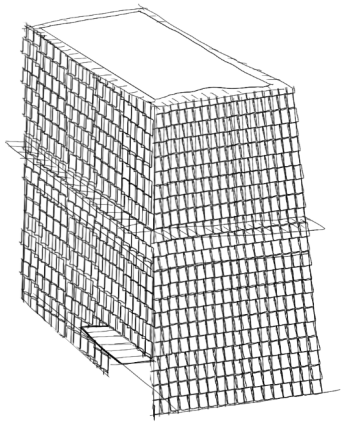


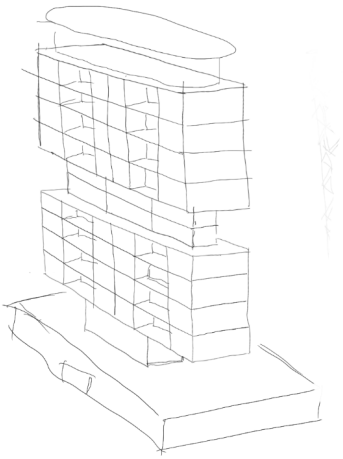
Korowai

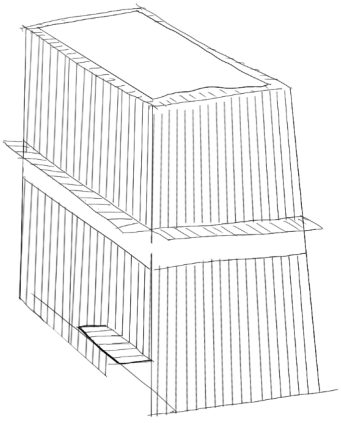
The structure has each level acting individually as a beam and spans from façade to façade, allowing all floors to be free of columns and structural walls. Every floor has interior and exterior beams spanning the façades, which avoids the use of columns due to the simple scheme that has the flooring spanning side to side. The outer layer of the building is inspired by the korowai, traditional Māori cloaks that are highly detailed garments, passed down through generations. Traditionally, korowai was used to keep the wearer warm and a decorative showcase of mana and prestige. Traditional korowai garments are constructed using the skills of raranga, weaving, that uses harakeke fibres called muka and various bird feathers from Tūī, Kākā, and Kiwi that hold great significance. The korowai on the Pā building acts as cladding that can open and close, creating a porch-like territory within the green band. The korowai aspect is also a filter for the building, controlling temperature and air flow. Thus, enabling the facade to capture surrounding environmental elements such as sunlight and heat. This façade also provides an opportunity for artistic freedom regarding the final aesthetic. Other opportunities can be pursued with for the korowai such as weaving panels creating a façade that displays Ngāti Whakaue people, history, and stories.

Figure – 76 Tūpuni/Encasement (2021), Pen to Paper









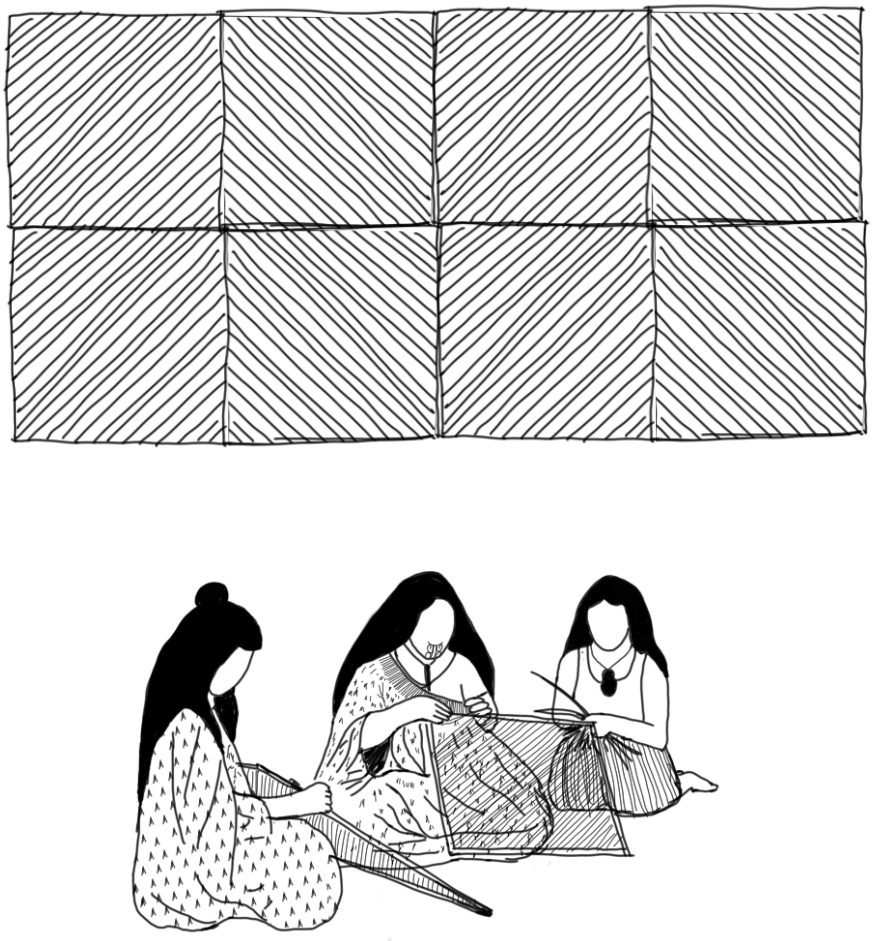


 Figure – 77 Tukutuku Opportunity (2021), Pen to paper

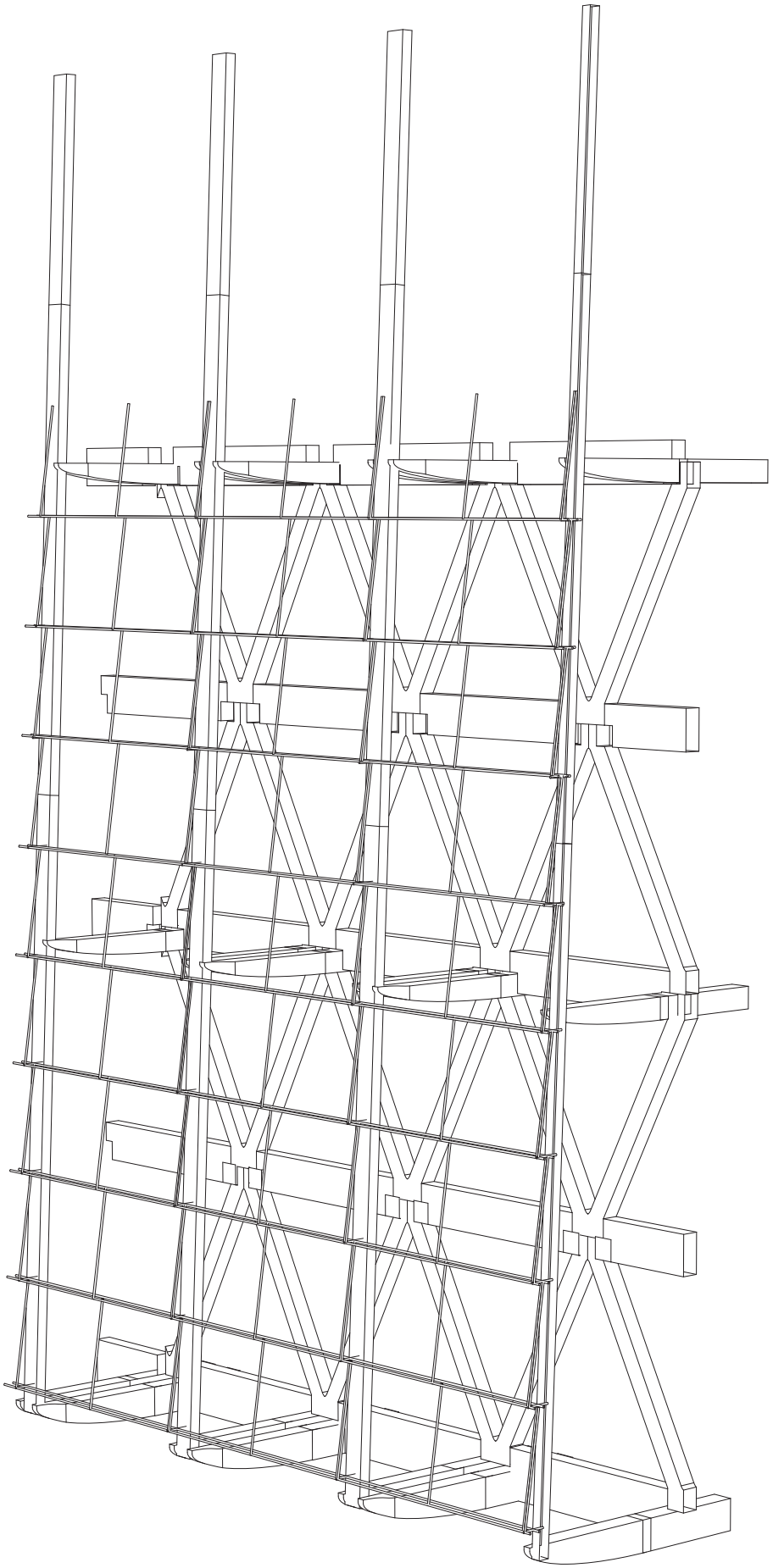


Figure – 78 Korowai (2021), Mixed Media

Te Pū - Te More

Phase One:

From the year 2025 to 2040 will be the initial planting of the ngahere, with the added outreach period to possible families who might occupy the Pā. The process will see its inceptions with the repurposing of whenua and prepping the land before planting seedlings. Pathways will be paved, and sections will be identified as future Pā. Once this is complete, planting will commence. Once seeds are planted, the footprints of the designated areas for the Pā will be identified by Ranginui structures. These structures will be used for water catchment purposes like drinking water and irrigation water to be used for the up keep of the plantation and sustainability of the growing plant life, and house facilities for the caretakers. These facilities will be modular made from glulam timber and easily disassembled when the time comes, providing the smooth transition heading into “Phase Two”. During this period of the project, Ngāti Whakaue may teach and share traditional knowledge regarding the planting process, educating communities on tree species, flora and fauna and how to look after and work with nature through a traditional Te Arawa narrative. This can be utilised as job opportunities for the community to care for the nursery and plantation, keeping the site environment authentically Māori and genetically Te Arawa. The ngahere will take time to grow, so it is important that the project moves forward in time and has the room needed to prosper. The annual meetings amongst shareholders and caretakers will be needed to allow for space for people to voice opinions and concerns during the initial project.

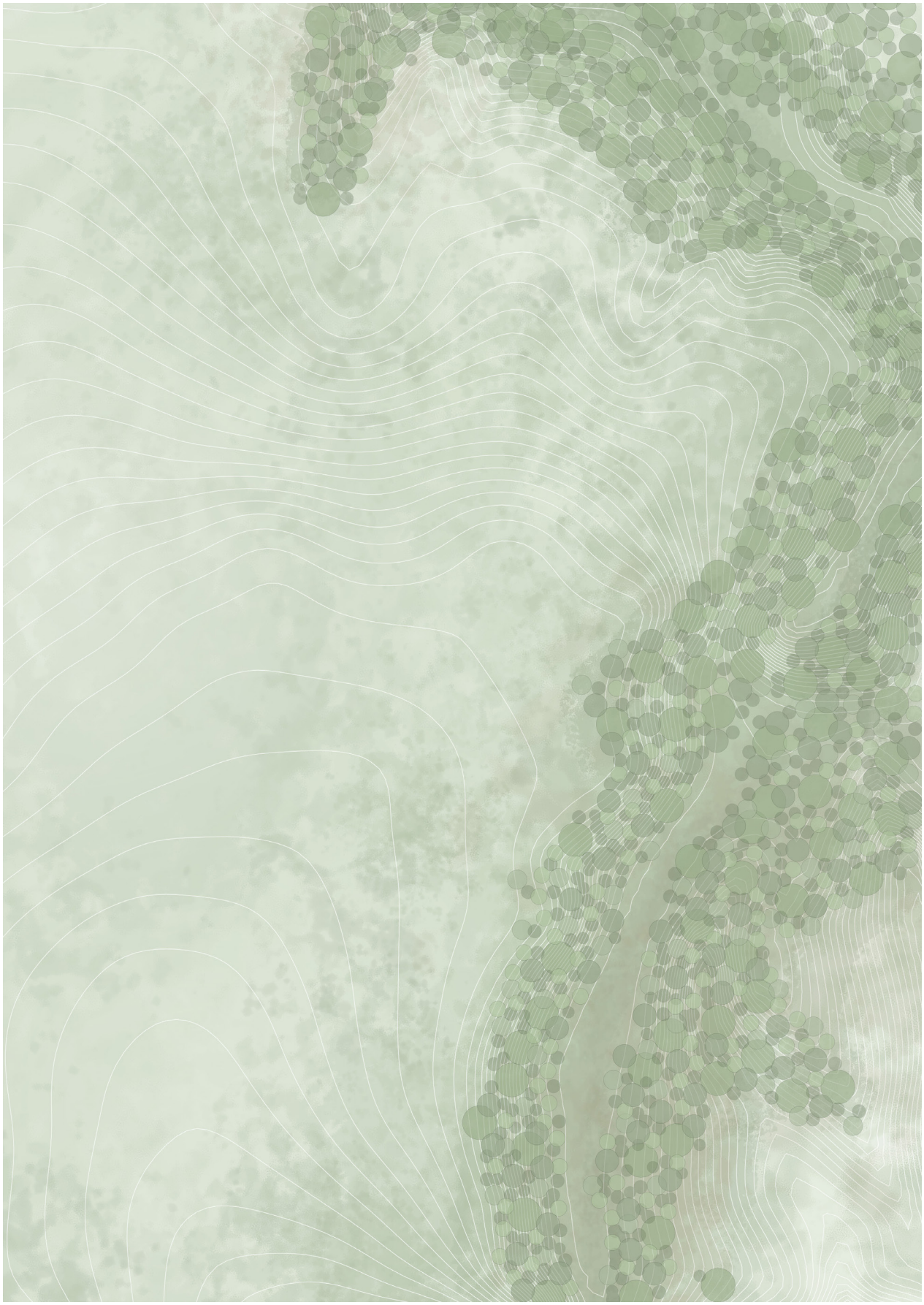


Figure – 79 "Te Pā" Site Plan of Whenua at Present (2021), Mixed Media

Figure – 80 "Te More" Site Plan of Phase One (2021), Mixed Media

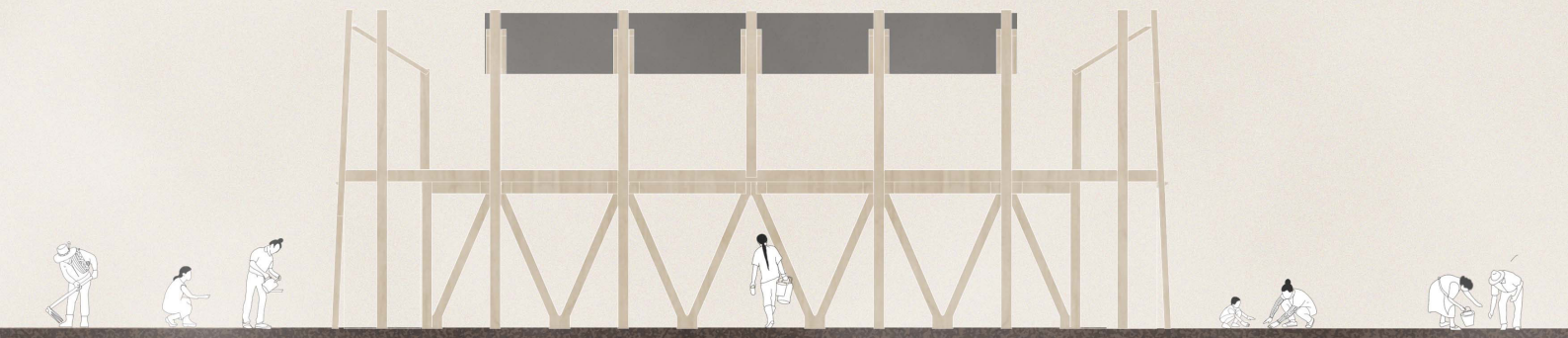


Figure – 81 "Te Whakahiapo" Elevational view of Phase one (2021), Mixed Media

Te Weu - Te Aka

Phase Two:

"Phase Two" sees the forest at the year 2040 where some trees reach heights, but the ngahere is still yet to be fully prosperous. 2040 will also see the introduction of the first stage of Pā developments being established, these replacing the early Rangi modules for living facilities. This will see the first look at the living Pā structures, each one aim to house not only families but ecosystems, encouraging co-occupancy to be lived and breathed. The structures will hold carparks beneath ground level, where we see the excavated whenua repurposed as a mound over and around the ground floor of the Pā. At ground floor we see occupants holding space with whenua access outward to personal gardens and crops and to the ngahere that surrounds them. A shared laundry area is also occupying this area.

As we move upwards through the terraced seating to the elevator shafts, we come to level one where the Pā opens upwards, allowing air to breath and light to pass through, while still being in the comfort of the indoors. This area is dedicated to the Pā entrance from public side of the building, as well as the communal wharekai shared by the occupants for special occasions and when bulk-scale cooking is desired for the whole Pā, a general custom for Māori to feed the masses. Through level one, we head upwards to the living quarters among the trees encased, by the green vegetation band. This area is dedicated to solitude for families, and if desired, to have privacy in their own space, while alternatively having the ability to be extended to the shared balcony space and shared māra kai that surrounds them. The living space is designed to be module walls and screens, movable and adaptable if needed, allowing growth intergenerationally within the Pā. This section will be replicated as extra floors are added to the building in its future when it is time for the Pā to grow and house more families. From the living quarters, we move up towards Rangi and see ourselves on the rooftop, where green roof garden beds are placed and layered to provide the building a natural rainwater catchment system. Water will be recycled and used throughout the building and the surrounding garden areas, minimizing the direct consumption of new water, and also saving energy. This first stage Pā structures will house families and will be shaped and adapted as the years go on and occupants move through the spaces. The growth of the Pā will depend on its occupants and technology of the time, whether new materials are introduced, or new practices are adopted.

Figure – 82 "Te Mahau" Perspective view (2021), Mixed Media

Figure – 83 "Te Weu me Te Aka" Site Plan of Phase Two (2021), Mixed Media

Figure – 84 "Motuhake" Sectional View of Phase Two (2021), Mixed Media

Te Rea

Phase Three:

"Phase Three" sees the project at the year 2060 where the Pā looks to expand as the ngahere that surrounds it has reached new heights. If they haven't already been created, additional Pā structures will be introduced to the whenua, as well as growing the existing structures. The growth of the Pā has developed with time, seeing old and new families together along with materials and eco-systems adapting and co-occupying its space. While this is being undertaken, care to the ngahere is upkept and observed. Between and before this time, bridges will be erected, connecting each Pā to the next. The paths are elevated to or above tree level connecting each occupant to the trees and the birds. This also gives the ngahere ground floor space to rejuvenate and minimise the effect of foot traffic degradation of the soil to prevent infections or unnecessary problems that can lead to death of plants. The desire is by this time of the project, families have grown along with their environment and have learnt to co-occupy space with each other.

Figure – 85 "Tūhāha" Sectional View of Phase Three (2021), Mixed Media


Water Filtration

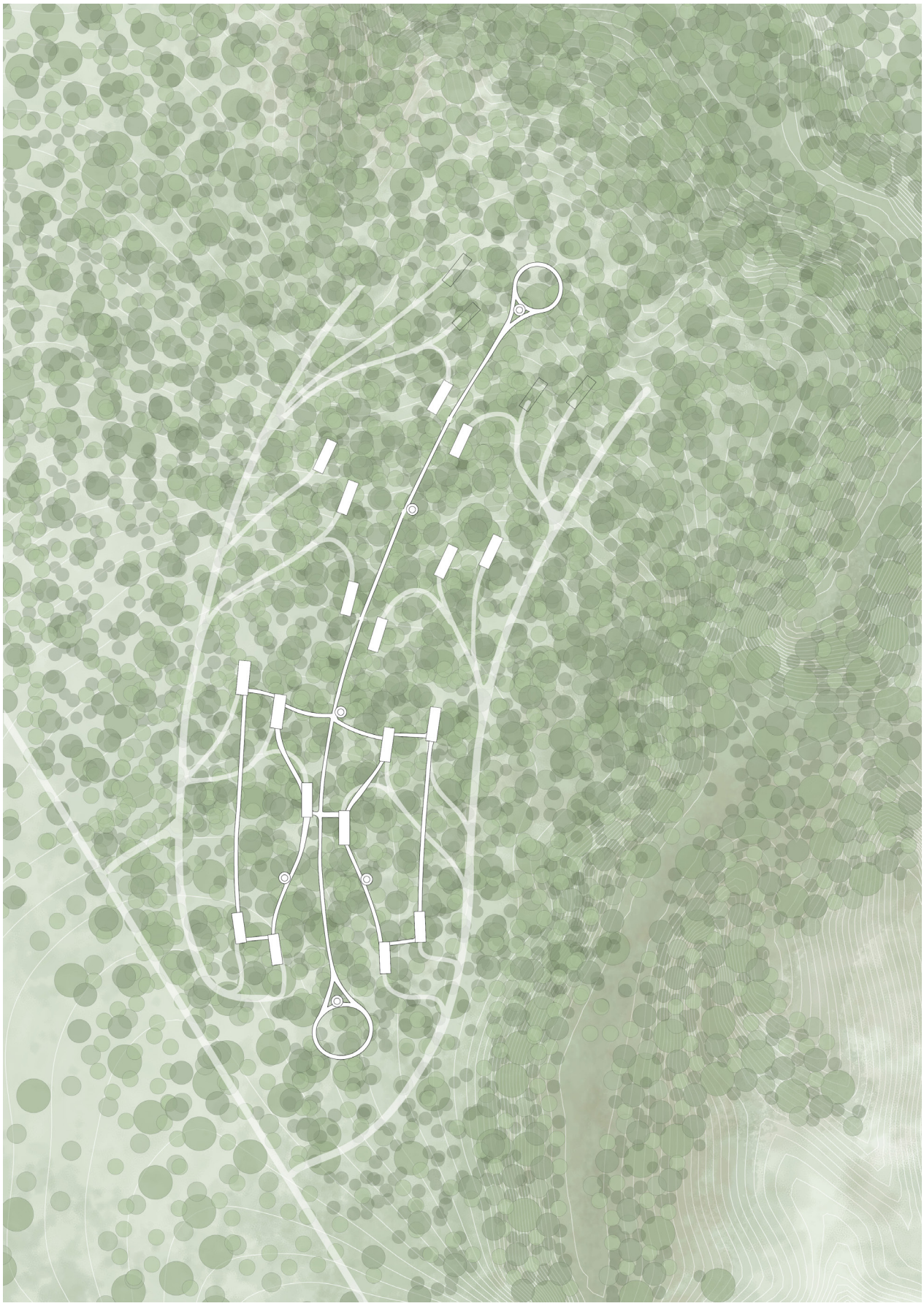


Figure – 86 "Te Rea" Site Plan of phase Three (2021), Mixed media

Figure – 87 "Te Aumārie" Perspective view of Living Pā (2021), Mixed media

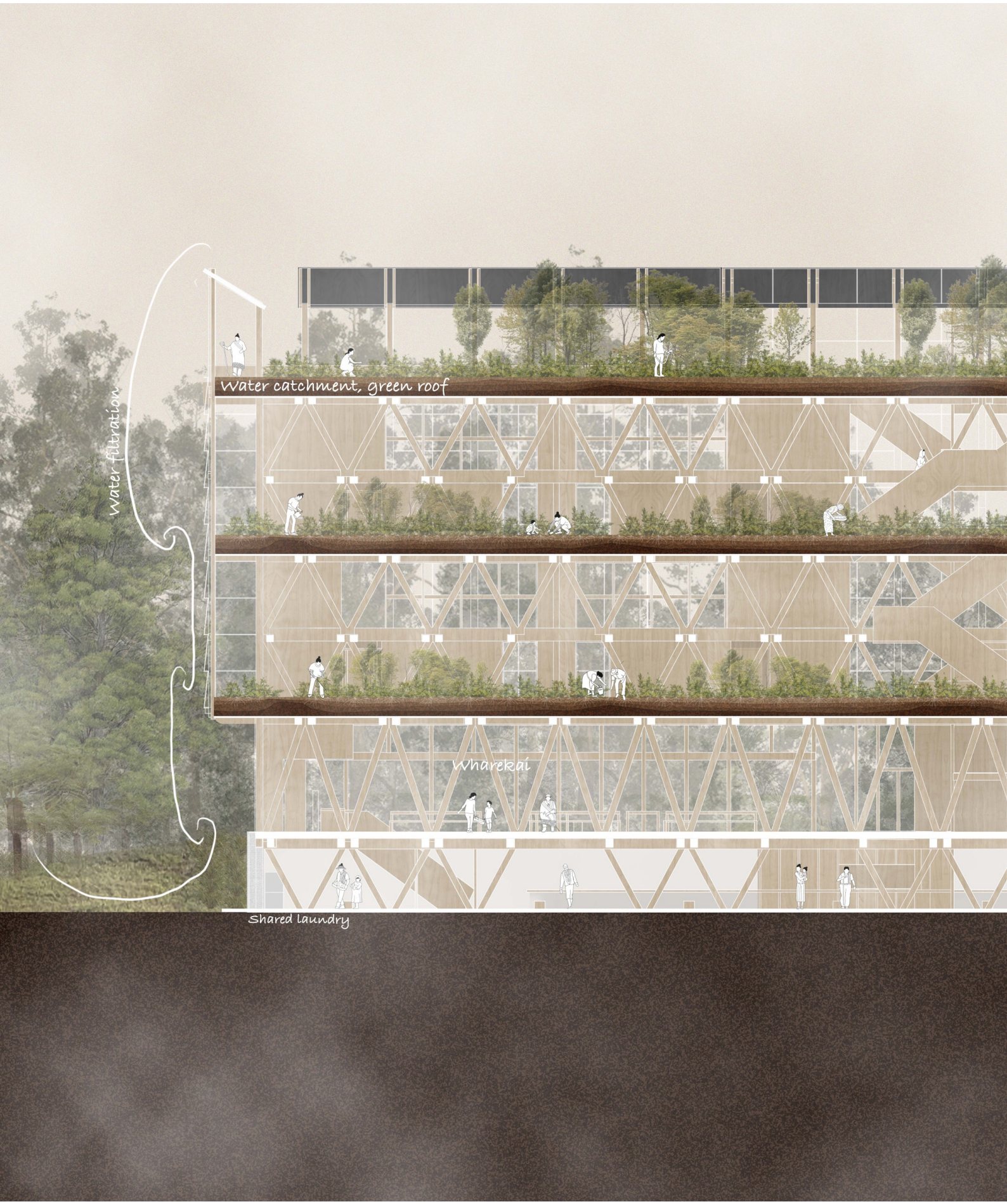
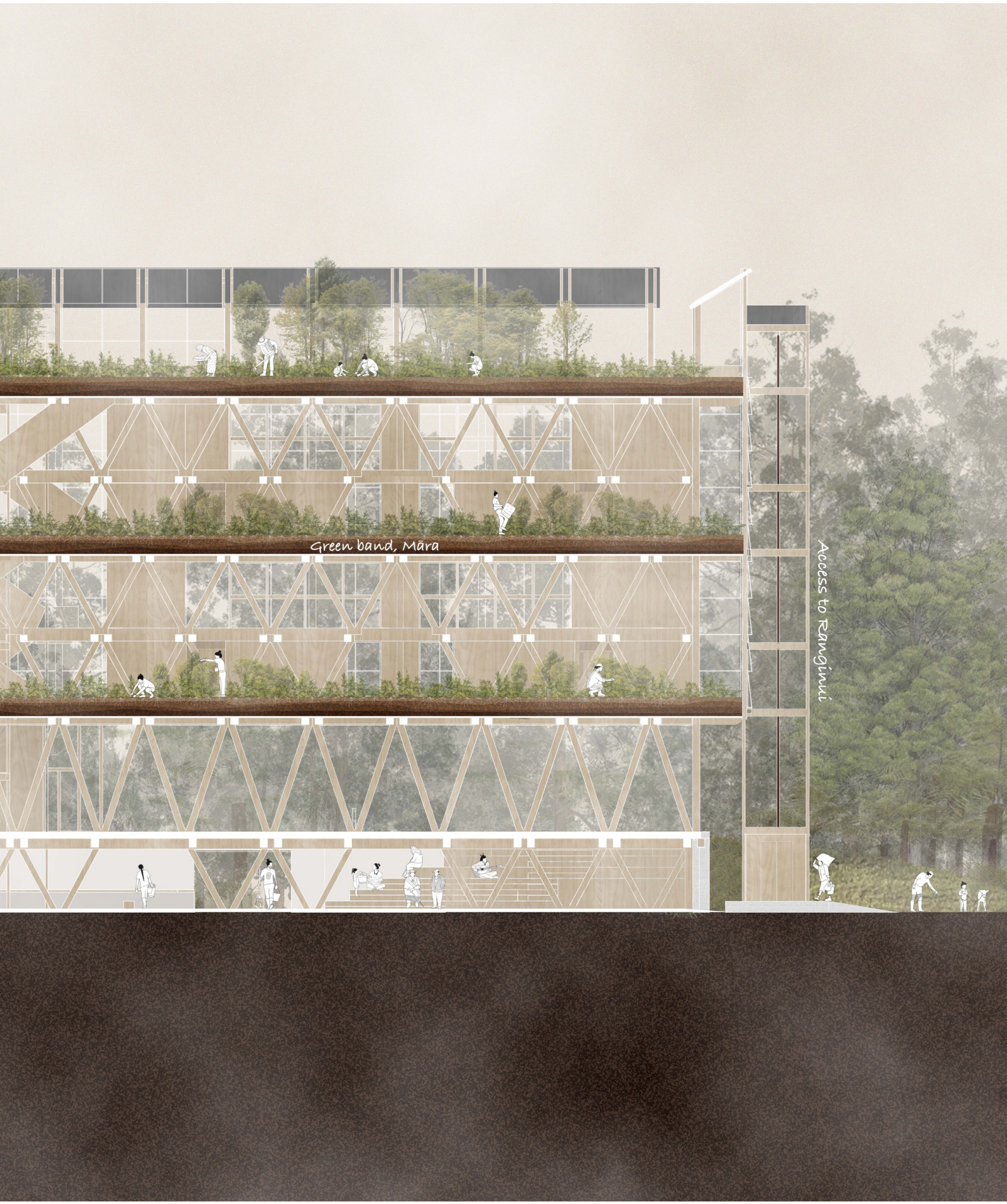


Figure – 88 "Huihuinga" Sectional view (2021), Mixed Media


Green band, Māra
Access to Rangiuui

Te Wao Nui

Phase Four:

"Phase Four" sees the project 100 years from its inception at the year 2125, where the Pā and ngahere have grown to be vibrant, self-sustaining and full of life. As the sun sets on one generation, it rises again for the next, on this 100th year, Pā structures are encouraged to be disassembled as other are erected to take their place. This phase will depend on what state the Pā state is in and whether or not the Pā noticeably needs to be disassembled, to be reassembled or the materials used can be recycled or join the journey of decomposition. This part of the project brings not an end to the Pā, but new beginnings bringing with it opportunity for growth. The Pā and its community have grown with the eco-system, its people syncing with its environment around them, moving through time and place together as one.

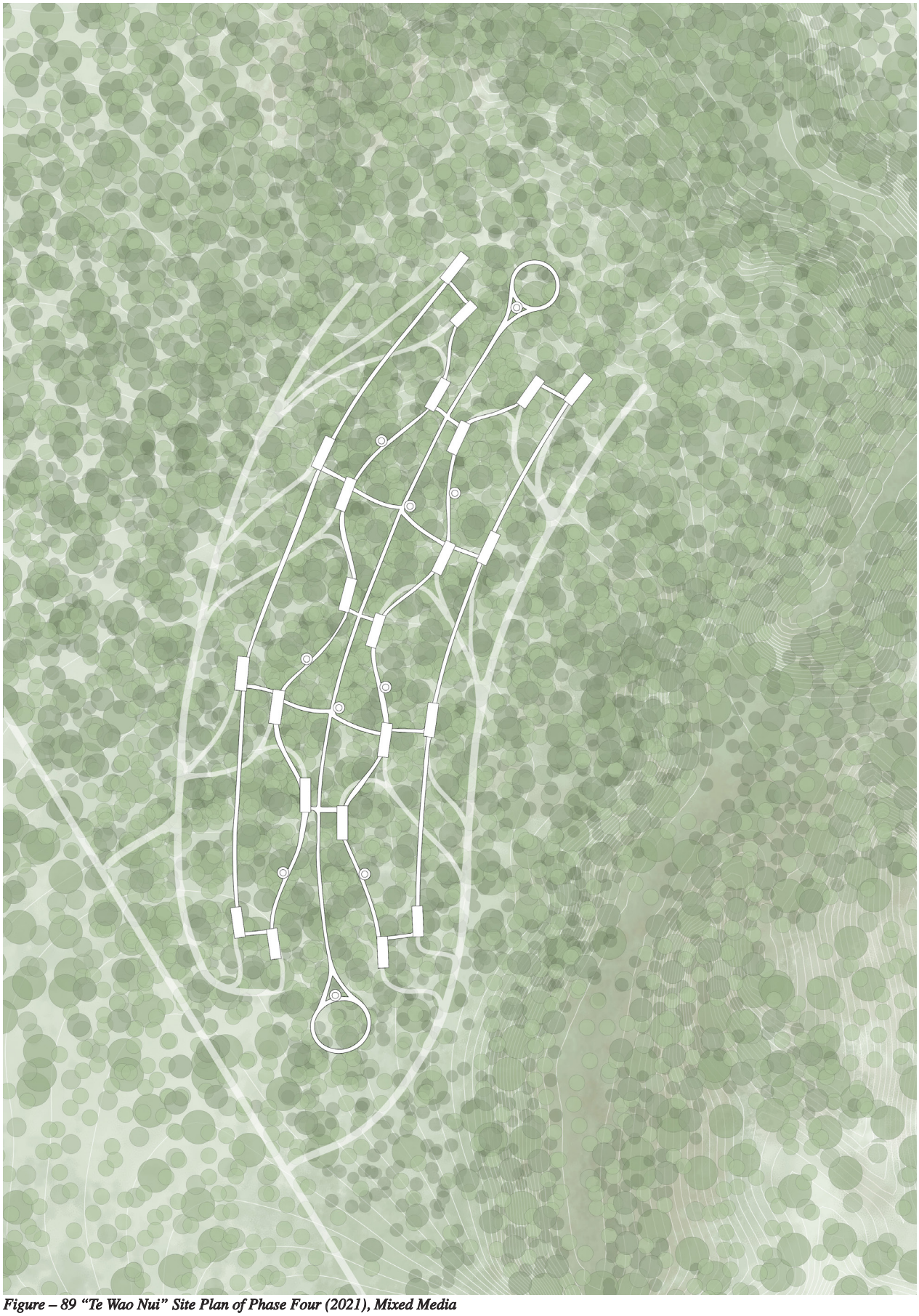


Figure – 89 "Te Wao Nui" Site Plan of Phase Four (2021), Mixed Media

Figure – 90 "Tūhononga" Front Elevation of the Living Pā (2021), Mixed media


Toi tū te whenua
Arapoutama

Te Mutunga

Conclusion

TŪHONONGA outlines the complex issues facing architecture in Aotearoa. Referring to our living and built environments within the Anthropocene that is ever present, TŪHONONGA questions how we build communities by proposing co-occupancy with taiao as an answer. It presents a method for how one might consider spatially interacting with time, Ranginui, Papatūānuku and space. While doing so, this project excavates and translates traditional Māori narratives regarding the topic of co-occupancy and how exchanging and co-occupying space with the physical and spiritual realms comes hand in hand in Māori culture, proclaiming this way of living can constitute within new or reclaimed living environments in Te Arawa and Aotearoa.

With the focus of the thesis being on unravelling co-occupancy with our environment within architecture, there was freedom to dissociate pre-conceived design processes by forming a different way of viewing methodology in rather taking an approach that is influenced by the life cycle of materials and our environment. Although this couldn't directly generate designs or architecture, it was evident that the customs of each method influenced the thought process and themes that inspired the drawings, diagramming and decision making through the research journey. The form of co-occupancy occurred differently in each part of the process.

The Living Pā is a product of thesis research provides a potential for architecture and taiao to hold a more cohesive future. The opportunity for repositioning the emphasis from buildings to environments reintroduces and improves communities through the connection to biodiversity and creating habitats for people and wildlife. As this research is grounded in Māori knowledge, it also offers Māori a way to reclaim and rethink our living environments and use of whenua, while being able to provide space that is authentically Māori, while having the mana to draw from both knowledge pools of Te Ao Pākehā and Te Ao Māori. This education is important for Māori communities to be privy to as Māori hold the majority when it comes to statistics of homelessness and poverty (Stats NZ, 2020). TŪHONONGA can provide a potential process and

The Living Pā can give iwi and hapū an alternative approach when considering housing whānau on their own whenua which is a clear common aspiration for many whānau, hapū and iwi, especially in Te Arawa.

TŪHONONGA presents a new way of perceiving co-occupancy and what co-occupying space with wider ecology through the practice of architecture, grounded in tikanga Māori at a physical, spatial and spiritual level may look like. The methodology presented provides a process for architects in Aotearoa to critically assess behaviour towards not only our built and unbuilt environments but also the communities that occupy them, human and non-human. Within the confines of Te Ao Māori, there is an abundance of customs that can set the precedence for co-occupancy and an example of how one might reconnect with nature and the natural eco-system. TŪHONONGA brings forth the potential for community living through spatial composition that is contemporary, yet grounded in the pursuit for co-occupancy with nature, traditional Māori narratives and a thriving culture.

Figures

References

Awatere, S., Pauling, C., Rolleston, S., Hoskins, R., & Wixon, K. (2008). Tū Whare Ora–Building capacity for Māori driven design in sustainable settlement development. Auckland: Nga Pae o te Māramatanga, University of Auckland.

Bäckstrand, K., & Lövbrand, E. (2006). Planting trees to mitigate climate change: Contested discourses of ecological modernization, green governmentality and civic environmentalism. Global environmental politics, 6(1), 50-75.

Bennett, J. (2010). Vibrant matter: A political ecology of things. Duke University Press.

Best, E. (2005). The Pa Maori: An Account of the Fortified Villages of the Maori in the Pre-European and Modern Times, Illustrating Methods of Defence by Means of Ramparts, Fosses, Scarps and Stockades (No. 6). Te Papa Press.

Best, E. (1982). Maori religion and mythology/2. Hasselberg Government Printer..

Bulmer, S. (1994). Sources for the archaeology of the Maaori settlement of the Taamaki volcanic district. Department of Conservation.

Cascone, S. (2019). Green roof design: State of the art on technology and materials. Sustainability, 11(11), 3020.

Department of Conservation. (n.d). Forest Habitats. Retrieved from https://www.doc.govt.nz/nature/habitats/forests/

Effekt.(n.d) Urban Village. Retrieved from www.effekt.dk/urbanvillage.

Environment Bay of Plenty (2010). Soils of the Bay of Pleaty Volume 2: Central Bay of Plenty

Field, C. B., Barros, V. R., Mastrandrea, M. D., Mach, K. J., Abdrabo, M. K., Adger, N., ... & Yohe, G. W. (2014). Summary for policymakers. In Climate change 2014: impacts, adaptation, andvulnerability. Part A: global and sectoral aspects. Contribution of Working Group II

to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1-32). Cambridge University Press.

Francis, R. (2021) Oral History: Kauae Runga.

Francis, R. (2021) Oral History: Karakia.

Future Library. (2014). Future Library. Retrieved from www.futurelibrary.no/

Hasson-Ohayon, I., Roe, D., Yanos, P. T., & Lysaker, P. H. (2016). The trees and the forest: Mixed methods in the assessment of recovery based interventions' processes and outcomes in mental health. Journal of Mental Health, 25(6), 543-549.

Hempconnect. (2020). Hemp: The Environemntal Benefits. Retrieved from www.hempconnect.co.nz/blog-2/2020/4/hemp-farming-environmental-benefits-sustainability

Kimmerer, R. W. (2013). Braiding sweetgrass: Indigenous wisdom, scientific knowledge and theteachings of plants. Milkweed Editions.

Kiyoaki Takeda. (2020). Tsuruoka House. Retrieved from dailyarchitecturenews.com/news/home-tour-tsuruoka-house-in-tokyo-by-kiyoaki-takeda

Kolb, M. J., & Dixon, B. (2002). Landscapes of war: Rules and conventions of conflict in ancient Hawai'i (and elsewhere). American Antiquity, 67(3), 514-534.

Kraaijvanger. (2012). City Hal Venlo. Retrieved from www.kraaijvanger.nl/en/projects/city-hall-venlo/

Larsen, S. C., & Johnson, J. T. (2017). Being together in place: Indigenous coexistence in a more than human world. U of Minnesota Press.

Macfarlane S, Macfarlane A, Gillon G. 2015. Sharing the food baskets of knowledge: creating space for a blending of streams. In: A. Macfarlane, S. Macfarlane, M. Webber, editor. Sociocultural realities: exploring new horizons. Christchurch: Canterbury

University Press; p. 52–67.

Macfarlane, A. H. (2006). Becoming Educultural: Te whakawhitinga o nga matauranga--Interfacing the Knowledge Traditions. Kairaranga, 7(2), 41-44.

Macfarlane, A., & Macfarlane, S. (2019). Listen to culture: Māori scholars' plea to researchers. Journal of the Royal Society of New Zealand, 49(sup1), 48-57.

Masson-Delmotte et al. (eds.) (2018). Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press.

McGregor, D. (2004). Coming full circle: Indigenous knowledge, environment, and our future. American Indian Quarterly, 28(3/4), 385-410.

Mitira, T. H. (1945). Takitimu. New Zealand, Wellington.

Munn, S., & Soebarto, V. (2004). The issues of using recycled materials in architecture. In The 38th international conference of architectural science association ANZAScA "Contexts of architecture", Launceston, Tasmania.

Neich, R. (2001). Carved Histories: Rotorua Ngati Tarawhai Woodcarving. Auckland University Press.

Nikora, L. W., Te Awekotuku, N., & Tamanui, V. (2013). Home and the Spirit in the Maori World. In He Manawa Whenua: Indigenous Research Conference.

Nikora, L. W., Te Awekotuku, N., Rua, M., Temara, P., Maxwell, T. K., Murphy, E., & Moeke-Maxwell, T. (2010). Tangihanga: The ultimate form of Māori cultural expression-overview of a research programme.

Piotrowski, S., & Carus, M. (2011). Ecological benefits of hemp and flax cultivation and products. Nova institute, 5, 1-6.

Rolleston, S., & Awatere, S. (2009). Ngā hua papakāinga: Habitation design principles. Mai Review, 2(2), 1-13.

Rotorua Land Use Dictionary. (n.d). Soil. Retrieved from https://landusenz.org.nz/soil/

Rotorua Museum. (2017). Social History: Fenton Agreement. Retrieved from www.rotoruamuseum.co.nz/blog/social-history-blog/2017/11/24/fenton-agreement-1880-2030/#_ftn1

Smith, L. T., Maxwell, T. K., Puke, H., & Temara, P. (2016). Indigenous knowledge, methodology and mayhem: What is the role of methodology in producing Indigenous insights? A discussion from mātauranga Māori.

Staford D. M. (1967). Te Arawa: A History of the Arawa People.

Stats NZ (2020). Housing in Aotearoa: 2020. Retrieved from www.stats.govt.nz.

Te Ara. (n.d) Volcanic Plateau. Retrieved from https://teara.govt.nz/en/volcanic-plateau-region/page-4

Te Ara. (n.d). Whakapapa. Retrieved from https://teara.govt.nz/en/whakapapa-genealogy/page-1

Thompson-Fawcett, M. (Ed.). (2010). Tāone Tupu Ora: Indigenous knowledge and sustainable urban design. Steele Roberts.

Tiakiawa, I. (n.d) Whaikorero Transcript.

Treadwell, S. (1999). 15. Categorical Weavings: European Representations of the Architecture of Hakari. In Voyages and Beaches (pp. 265-284). University of Hawaii Press.

Ulrich, R. S. (1993). Biophilia, biophobia, and natural landscapes. The biophilia hypothesis, 7, 73-137.

White, R., & Heerwagen, J. (1998). Nature and mental health: Biophilia and

biophobia. The environment and mental health: A guide for clinicians, 175-192.

Wihongi, H. (2013). Tangihanga: Through the eyes of young Maori women (Doctoral dissertation, University of Waikato).

Wilson, E. O. (1984). Biophilia. Harvard University Press.

WordSense Dictionary. (2021). WordSense Online Dictionary. Retrieved from https://ww.wordscene.eu/cooccupy

Yates, A . (2017) Mauri-Ora: Architecture, Indigeneity,and Immanence Ethic