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# The Woven Narratives

**Weaving climate change science, ecologies  
and Mātauranga Māori through spatial  
constructs.**

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An exegesis presented in partial fulfilment of the  
requirements for the degree of Masters of Design at  
Massey University, Wellington, New Zealand

MERCIA ABBOTT 2021



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Ko Te Poho o Tamatea te maunga  
Ko Whakaraupō te moana  
Ko Ngāi Tahu te iwi  
Ko Rāpaki te marae  
Ko Ngāti Wheke tōku hapū  
Ko te Rakiwhakaputa tōku rangatira  
Ko Hera Hutai tōku pou wahine  
o te whānau Watene  
Ko Teone Watene rāua ko Wiremu Pareita Watene ōku tūpuna

Ko Rangitūmau te maunga  
Ko Ruamahaunga te awa  
Ko Takitumu te waka  
Ko Ngāti Kahungunu tōku iwi  
Ko Papawai tōku marae

Ko Ida Tawhiri tōku māmā  
Ko Robert Kerr tōku pāpā  
Ko Jason Abbott tāku tane  
Ko Monti raua ko Beau āku tama  
Ko Mercia Abbott tōku ingoa



First, I acknowledge my whakapapa. Whakapapa narrates our life through the people and places we come from (Roberts, 2013). It is a tool of knowledge and wisdom that connects us to our environment and to the atua who personify these lands. Everything is woven together in this intrinsic genealogical web: the tangible and the intangible.

It is within this process of discovery into my own whakapapa, that I have unearthed and built upon my own connections to the whenua. I acknowledge the inherent disconnect and mourning I have experienced at the loss of not truly knowing my own culture and that this is the by-product of colonisation.

Throughout this project I have come to understand many injustices, power struggles and terminology that does not sit well. The term “landscape,” for example, is a colonial device that seeks to allude to a picturesque and scenic view, one that is highly constructed and therefore problematic.

Instead I infuse the word whenua. Whenua is a holistic term that is about nurturing and sustenance. It holds the same meaning as the word placenta, whenua ki te whenua is the

practice of burying the placenta into the earth, imbuing and reinforcing the relationship to Papatūānuku, something I did for my children.

Through this Master’s Degree, I have become more comfortable with this newfound knowledge and understanding of this bicultural world and where I stand within it. I hope by reading my whakapapa, this allows you to have some insight into who I am before engaging with my thesis.

**Ngā mihi.**

Figure 1.  
Pampus Grass | threat, Kuku





## Acknowledgements

To my husband Jason, thank you for holding down the fort, picking up my slack and giving me the space and time I needed. To my beautiful boys Monti and Beau, thank you for reminding me that family comes first and that there is always time to play, talk, read a story and snuggle.

Mum, thank you for all you do. Always! Your love, strength and support in all its shapes and forms is my one constant.

To my lovely in-laws, your support and help is much appreciated.

To Huhana Smith, thank you for the opportunity to be a part of a very special project that has encouraged me to understand more about who I am, where I come from and what my cultural connections are. I value the knowledge and wisdom you have shared with me and appreciate your guidance along the way.

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And lastly thank you to the iwi and hapū of kuku, for sharing your stories, time and knowledge with me. Aroha nui.

## Abstract

The threat of sea level rise and climate change is inevitable and happening. Indigenous coastal farming communities in particular, are at risk from coastal erosion, storm surges, groundwater inundation by salt water and extreme weather and flooding events. Many of these communities are slow to act due to a disconnect in synthesising western and indigenous knowledge systems.

We are constantly told about the effects of climate change and there has been a lot of research compiled, data collected, collated and measured. The problem is it can be difficult to engage with science, due to statistics and figures that can feel psychologically distant and impersonal. This results in a lack of clear communication and difficulty for our communities to actively engage in and fully implement change.

This thesis aims to address this disjuncture by weaving western science with mātauranga Māori knowledge systems to produce meaningful mahi that enhances cultural understanding, taonga species and environmental wellbeing within the Kuku rohe, in Horowhenua, south west coast of Te Ika-a-Māui, Aotearoa.

A way of overcoming disconnection is to use

Spatial design as a generative tool through the use of innovative 3D spatial modelling technologies, to construct embodied narratives that communicate the importance of climate change and mātauranga Māori. Spatial design does this by using immersive and atmospheric environments that enable people to connect to uncertain outcomes of climate change and to communicate people's experiences, knowledge, stories and lives alongside scientific data. This enables a form of communication that can be understood and felt in terms of both the tangible and intangible, connecting people and data through this contact zone of shared suffering due to climate change.

This mahi employed Kaupapa Māori methodologies such as: Whakapapa defined as genealogical systems that explain the intricate relationships between humans, cosmologies and everything within nature.

Wānanga or embodied workshops took place with kaumātua, kaitiaki, iwi, hapū and researchers in climate change science and ecosystem services. Hīkoi involved walking, talking, meeting of minds, bodies and hearts to experience the land. Kōrero tuku iho is another method defined as past, present and future, oral

narratives and pūrākau which are stories that shape our understanding, knowledge, values and worldviews of distinct places. These kaupapa Māori methodologies are crucial for effective engagement and have resulted in creating a combined richness of shared knowledge and expertise. Each method provided first-hand experience of ecological concerns and loss of natural integrity, mauri and wellbeing, integrating embodied knowledge, climate change science and data. Collectively, they offered culturally sensitive information for more responsive collaborations, with spatial design as the tool that weaves these knowledge systems together.

This engagement sets up a potential model for other coastal communities to aid them in understanding today's unfolding climate crisis and assist in implementing place-based change.





Figure 2.  
Disintegrating Dunes, Kuku  
Beach.

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# past

Ki mua, ki muri –  
walking backwards into the future

The word mua means "the front", but it can also mean "the past".

This is a Māori world-view inherent in te reo

In English, it's usual to think of "the past" as being "behind" one.

In te reo, however, "the past" is considered "in front of" one – because it has preceded or "gone before" the present.

In a similar manner, muri can mean "back", but muri can also refer to "the future" or that which is yet to come.

Hence the concept of "walking backwards into the future".

(KARENA-HOLMES, 2019).



Figure 3.  
Manu in flight, Kuku



# chapter one

## 1.1 Kete of Knowledge

This project has been a loving work in progress since 1996. Dr Huhana Smith, who is the head of Whiti o Rehua School of Art at Massey University, is the principal researcher who collaborates closely with her iwi, hapū, other multidisciplinary researchers and key stakeholders. Their collective efforts have and continue to involve research grounded in the Ōhau - Kuku - Waikawa coastline in Horowhenua.

The research explored ways to catalyse this coastal farming community to adapt to climate change. Investigation into this important research to date has been a key source of material for this thesis.

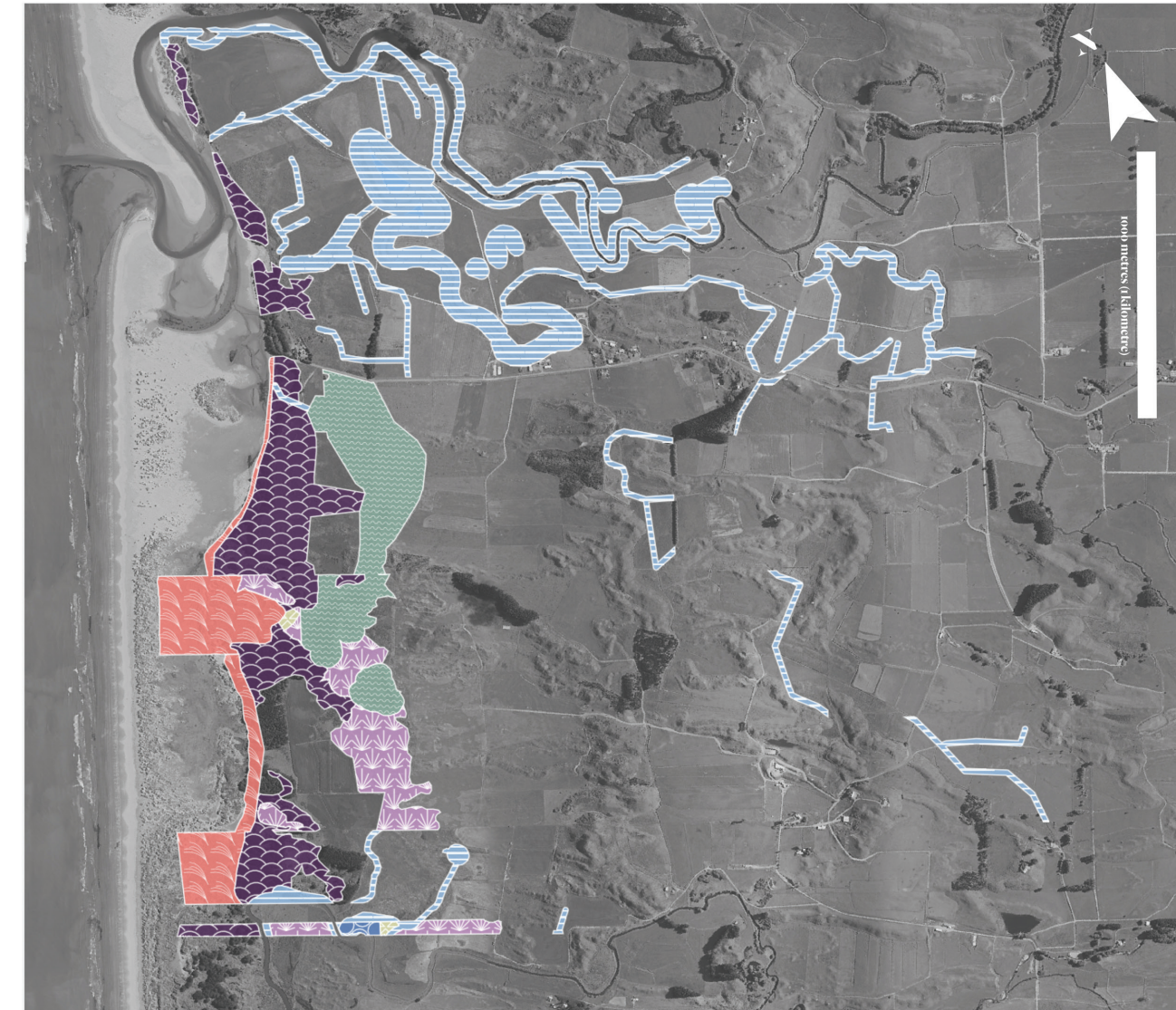
The following is the breakdown of Phase One and Two, stating some of the research findings that have been critical in developing Phase Three as part of a sequential Deep South National Science Challenge Project.

I am currently working in collaboration with the team for Phase Three, and it is the basis of this Masters of Design.

### Phase One

The focus of Phase One was to improve the resilience of the coastal environment to the impacts of climate change, and to assist Māori in adapting to the rising seas, increased flooding, salinisation of groundwater and addressing both short and long term impacts. It also aimed to combat the erosion of the beaches and the collapse of the coastal infrastructure due to increased rainfall, storm surges and the predicted increase in westerly winds.

Questions embedded into the research looked at 'how to maximise economic productivity and protect coastal farms?' As well as how to protect the whenua and maintain cultural heritage? These aimed to encourage visions, strategies and actions that adapt housing, agriculture and ecosystems (Allen et al., 2011).



## ko te tiakitanga me te whakaoranga

### protection and restoration

#### TRANSITION PHASE 1 | ACTION NOW

To improve the resilience of the coastal environment to the impacts of climate change.

Protect coastal dunes, wetlands and rivers by extensive native planting to improve the resilience of the coastal environment to the impacts of climate change.

-  Harakeke Planting.
-  Native Dune Planting.
-  Pīngao Planting.
-  Riparian Planting Wetland.
-  Aquaculture Ponds.
-  Papakāinga Site.
-  Riparian Margin.

Figure 4. Summary of phase one | protection and restoration



## Phase Two

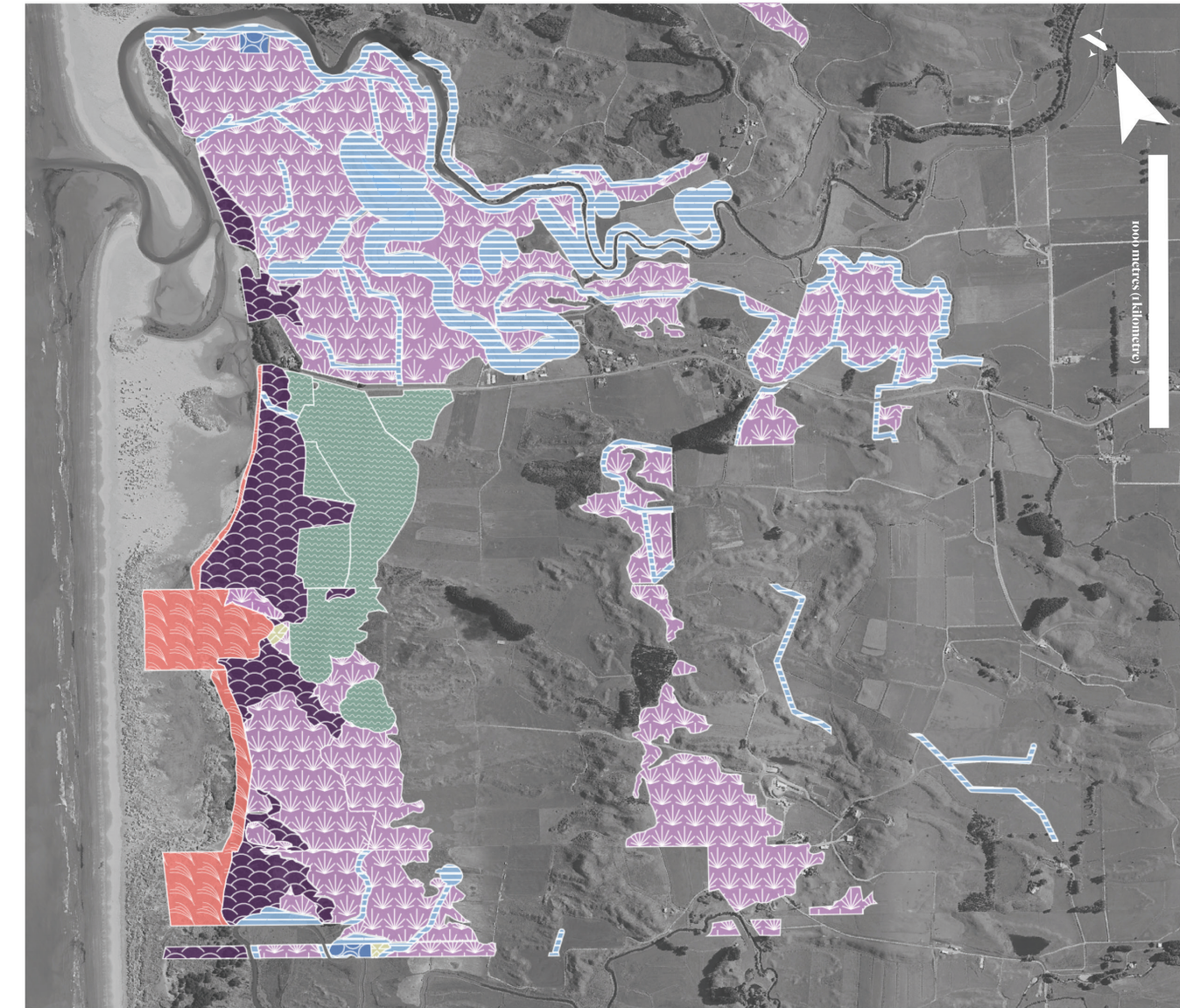
The Phase Two research project emphasised improved communication strategies in order to actively assess all risks and simultaneously co-create transition action plans.

It involved adapting and diversifying farming practices that depart from typical dairy farming operations, finding alternative ways to work with the predicted climate change outcomes such as rising seas. It explored the revitalisation of the harakeke industry, which has the ability to provide environmental, cultural, social and economic benefits.

The Manaaki Taha Moana (MTM) Enhancing knowledge of inanga habitat looked at inanga knowledge and restoration processes, and monitored egg laying and spawning habitat in the lower reaches of the Ōhau loop. The aims were to increase local knowledge of egg-laying habitats or spawning areas, enhance freshwater fisheries by installing artificial inanga habitat temporarily, and to assess the effectiveness of this as a strategy for improving spawning in the area (Taylor et al., 2015).

This body of work is incredibly rich in drawing on both research and expertise from multiple knowledge systems and ultimately it has identified the fragility of our coastal environment and the importance of community engagement and action.

All phases of the research were grounded in a kaupapa Māori framework embedding mātauranga Māori, a body of knowledge that draws from and reinforces the holistic connection that Māori have to whenua. It draws on our inherent connections to the ecosystem, spiritual beings and other living species that we share the land and water with. This cultural knowledge alongside climate change science, geomorphology, ecological economics and design principles are used, in order to inform new paradigms for resilience and adaptation for coastal Māori communities.



## ko te urupare me te whakawhitinga

### adaptation and diversification

TRANSITION PHASE 2 | NOW - 30+

Finding alternatives to dairy farming and grazing when paddocks succumb to sea level rise.

Revitalising the harakeke industry and extending its use to new products and enhancing cultural traditions.








-  Harakeke Planting.
-  Native Dune Planting.
-  Pīngao Planting.
-  Riparian Planting Wetland.
-  Aquaculture Ponds.
-  Papakāinga Site.
-  Riparian Margin.

Figure 5. Summary of phase two | adaptation and diversification.



## Phase Three

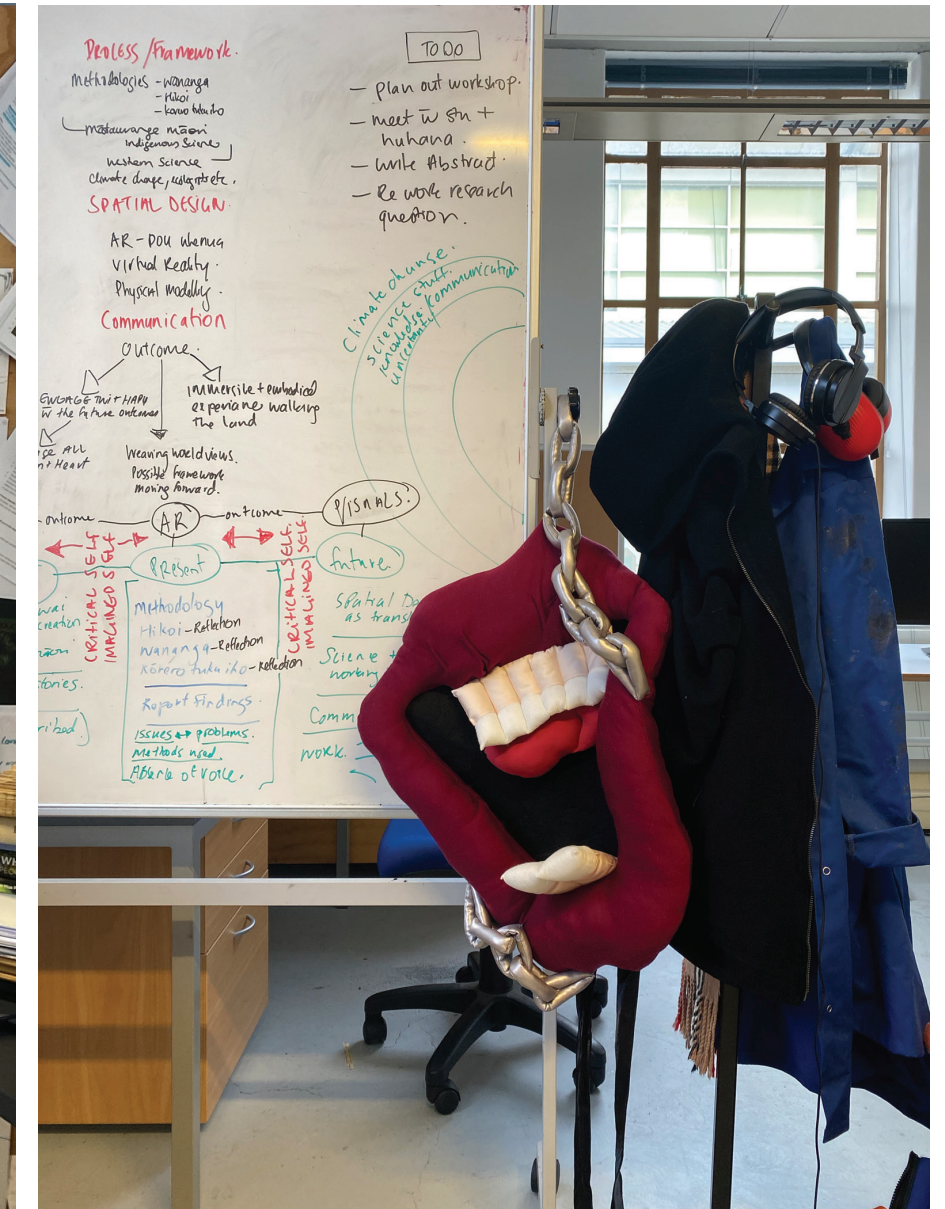
I have been fortunate enough to be brought into this very special project as part of the Deep South National Science Challenge Phase Three.

The deliverables set for me that I will adhere to include:

- 1) Investigating action orientated climate change transitions to water based land uses according to iwi aspirations that enhance taonga species, namely tuna (eel) and īnanga (whitebait).
- 2) Helping researchers and whānau to co-design solutions that enhance sustainable tuna and īnanga production, both onsite and through work that builds upon the previous two phases of research, with a continued focus on lower reaches of the Ōhau River.
- 3) Designing natural ponding systems with hapū and Rebecca Eivers, a Freshwater Ecology & Wetland Specialist, and Christian Zammit, a hydrologic modeler.

4) Locating best placement for potential ponding systems and co-developing an implementation plan that will include īnanga within the case study rohe (area). This will include factors such as water take/abundance; quality of groundwater aquifers, surface water, and river/stream systems; adequacy of ground water monitoring and reporting.

Figure 6  
Workspace | developing phase three





## 1.2 Research Aims, Intentions and Question

The aims and intentions set for myself for this Masters project are devised through the lens of a spatial designer.

Spatial design is driven by a rich understanding of spatial experience, which has the ability to create, shape, alter, visualise and communicate people's experiences, knowledge, stories and lives, from our everyday rituals and moments, to the extraordinary ones.

I come into this project to utilise my diverse toolkit of visualisation skills and techniques, including the use of 3D spatial modelling technologies, AR and VR capabilities, to communicate the needs of this rohe. To work within a kete of people committed to understanding future scenarios of climate change, and implementing adaptation strategies that seek to protect these local treasured ecologies. To understand the complexities intertwined in this mahi including the tangible and intangible, I have tried to translate this work in meaningful ways.

I have listened, observed, understood, interpreted, learned, engaged and brought my abilities to assist in taking action.

There are many facets to this project, but my grounding research question for my Masters is: **How can spatial design be used to weave multiple narratives, climate change science, ecologies and mātauranga Māori knowledge, in order to produce meaningful kaupapa that enhances cultural understanding, taonga species and environmental wellbeing within the Kuku rohe in Horowhenua?**

I am compelled to enhance the potential of this project, and on this basis for my work to be shared with other coastal communities.

## 1.3 Between the Mountains and Sea

Bounded to the Ōhau river to the North, the Tasman Sea to the west, the foothills of the Tararua Ranges to the east and nestled between Levin and Ōtaki 83 kilometers north of Wellington, sits Kuku. This is the ancestral whenua of Ngāti Tūkorehe and associated hapū including Ngāti Te Rangitāwhia, Te Mateawa, and Ngāti Kapumanawawhiti.

Figure 7.  
View from above | looking south





## 1.4 Past Visualisations

**Pre Colonisation:** This cultural land would have looked very different with its pristine streams, moist climate, lagoons, extensive native lowland forest, dune wetlands and rich alluvial soils. Native pukio, wīwī, raupo and oioi would have lined the edges of the waterways. Kōwhai, ngaio, koromiko provided protective barriers and dune land cover along walking tracks. Soil, cloaked in manuka, karamu, toetoe and harakeke. Inland large totara, tītoki and matai stood tall mixed with smaller kawakawa, makomako and kōhūkōhū with kererū, kākā and tūī perching on their branches (Lucas Associates, 1998; Smith, 2007). Cultivated gardens near papakāinga produced kūmara, riwai and taro and the wai teemed with flounder, mullet, īnanga, tuna, pipi and tohemanga (toheroa).

Māori have an intimate relationship with the whenua, everything is interconnected and dependent on each other (Hamsworth, 2013).

Figure 8.  
Maramataka | lunar phases



Food sources were seasonally harvested, hunted and gathered based on the maramataka (the lunar cycle), reading the triangulation of tohu 'tohu kei te rangi, tohu kei te whenua, tohu kei te moana' the sign in the sky, the sign on the land and the sign in the water (Auckland live, 2021). These culturally embedded knowledge systems are derived from lived experiences and traditional observations (tirotiro) to help understand our place in the natural world. This also speaks to the notion that time is a cultural construct, a western notion that is linear, structured and stretched into minutes, hours and days, conceived in terms of economic return. Māori conceived of time in cycles, time that folds in on itself. It is fluid and is understood by working with nature not commanding it. For example

**“When the star Rehua (Antares) rises above the horizon before dawn, we know that the days have become full and long. Together with the blooming pōhutukawa and the nesting kererū, our tūpuna recognised these signs as the arrival of summer” (Te Miri Rangi, 2017).**

Summer did not occur on an arbitrary date. However, we are told in mainstream education that the official start date for Summer is the 1st of December every year as per the Gregorian calendar cycle. Looking to the Māori concept of marking time, these culturally embedded knowledge systems are based on lived experience and established core values such as manaakitanga (showing and receiving care), kaitiakitanga (guardianship), and tikanga (protocols) - to name a few. Mātauranga Māori, (Māori knowledge) is based on these understandings and close observations of the

natural environment, and such knowledge permeates the land and people with mauri (life force) and mana (spiritual power) that is then inherited and transferred intergenerationally through waiata, pūrākau and cultural practices.

**“The land was not only an important resource ecologically, it was also the holder of rich interwoven cultural narratives that spoke to their ancestral conquests, occupation and special burial sites. A balance of the cultural and spiritual associations to the entities of these natural areas” (Smith, 2007).**

**Post Colonisation:** A gradual change of economies occurred and with it came changes in the whenua. According to John Wehipeihana, between 1820-1928 Kuku experienced four phases of Pākehā influence.

First, was the introduction of the potato, which required space to cultivate it. Second, came the trading of harakeke, potatoes, kūmara, maize, wheat, cattle and pigs. Traditional Māori exchange was a reciprocal gift exchange based on need, not on the production of goods for sale (Wehipeihana, 1964). The third phase was the development of refrigerated transport systems, which opened up trade possibilities with overseas markets. The fourth and perhaps the most damaging phase involved the subdivision of a 300 acre property into 50 acre

farmland blocks, initiating a more intensive form of land use. This clearly looked at the land as a commodity for profitability, not as an ancestral legacy or nurturer of communities (Patete, 2021).

This increased tempo of economic activity and growth resulted in more than half of the extensive native forests being depleted, whereby the once proud totara, kahikatea, matai and kohekohe were felled and burned. Native pukio, wīwī, rushes and other growth considered redundant were ripped out. Estuarine reed marshlands were reclaimed, wetlands were drained, and the introduction of non native plants, pests and disease infected this once highly fertile and thriving land.

Figure 9 and Figure 10.  
Ōhau Valley | Ōhau River both c. early 20th century



**“By the 1990’s, last vestiges of other natural food resources had deteriorated so rapidly from ongoing inappropriate or unsustainable actions, that they were virtually non existent” (Smith, 2007).**

Iwi and hapū understand that the natural world and all contained within it are taonga and revered and the current degradation of the wai and whenua are felt and mourned. But there is also a strong willingness to address the problems, remedy the past and create action adaptation strategies. These actions are about reconnecting to the whenua and its wairua, as the spirit or essence of place.



## 1.5 Kuku in Crisis

**As part of this project,** I looked at the Ōhau River 'Loop', which was once part of a meandering tidal section of the lower reaches of the Ōhau River. Between 1972-1974 flood protection works on the lower portion were conducted. This 3.5 kilometre meander was essentially cut off from the main flow creating 'The Cut,' which is a diversion channel that bypasses the remaining 'Loop'. The creation of the cut prevented the flushing of fine sediment resulting in a build up of organic waste and silt from the surrounding farmland. Today, the Loop is surrounded by intensive dairy farming (Smith, 2007).

**“The cattle destroy the fragile soil structure, the water quality is poor and has degraded biodiversity, and there are polluted waterways and an abundance of aquatic weeds” (Taylor et al., 2015, p.7).**



Figure 11.  
Desolation of Papatūānuku | Kuku in crisis

This has had detrimental effects on taonga species, specifically īnanga, which spawn on a spring tide from February to April, laying their eggs in the vegetation on the riverbank next to the awa. Īnanga require protected areas that are cool and moist as these eggs remain there until the next spring tide when they are picked up by the wai, hatch into the stream and

head out to sea. However, livestock graze up to the edge of the awa damaging and leaving vulnerable eggs out to dry. Flooding events wash the eggs out to sea early, interrupting the cycle. The increase of pollution creates an uninhabitable environment for these taonga. This emphasises the inherent damage that climate change impacts indicated in phase one



and two, including sea level rise, extreme flood and weather events present to the rohe.

Currently this Māori landholding in Horowhenua is wet and getting wetter. This year alone there have been two major flood events, the latest on the 16th of July 2021, where flood waters breached the stop banks with waters rising



to an estimated three meters. This height was indicated by the debris found high up in the branches of willows on the river's banks.

The cultural effects are immense, creating a sense of loss and mourning not only from the lack of mahinga kai but also in the loss of resource gathering traditions and land based



customs/ tikanga that pass on this knowledge. This results in not only a depletion of mauri but also an acute disassociation between land, peoples, and water culture.





## chapter two

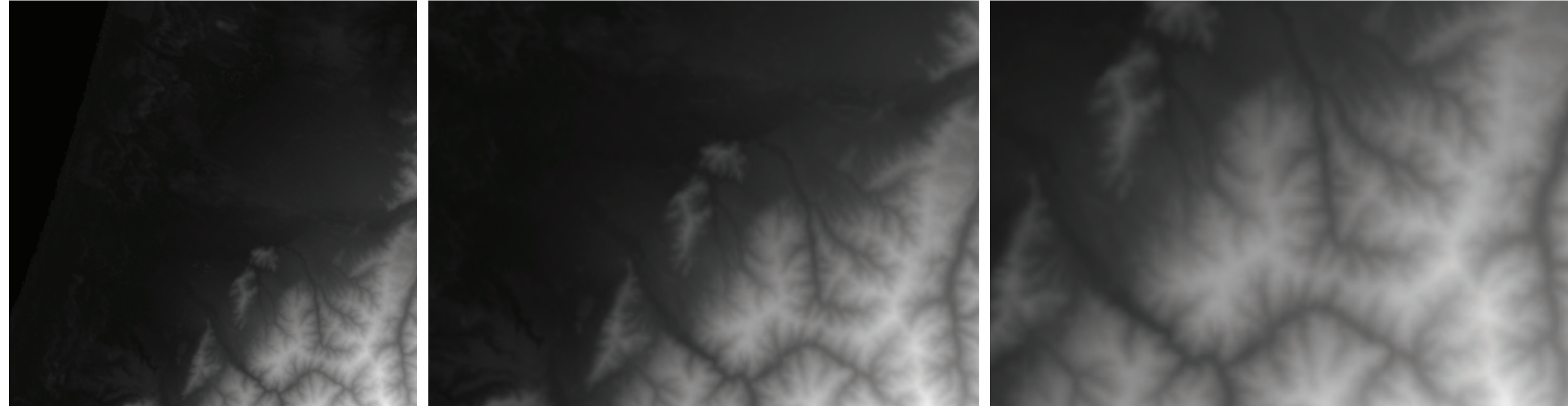
### 2.1 Whakapapa

Understanding whakapapa is fundamental when looking at Māori values and their connectivity to the environment.

Whakapapa can be understood as interrelated genealogies, ancestral links and relationships between wai, whenua and tangata whenua, and all that live within them. It is also understanding our connection to the atua through the origin of our universe stretching back to Te Kore - the nothingness, Te Po - the long long dark nights to Te Ao Marama - the world of light. It began with the creation of Ranginui and Papatūānuku and the birth of their tamariki, understood as the sea, rivers, forest, flora and fauna and animals through to the emergence of humankind (Hudson, 2001).

Whakapapa is what connects us to our past, present and future, a continuous series of layers rooted to both the corporeal and incorporeal. Simply, all living things have a whakapapa that connects us to all of creation (Mead, 2003). We are a world of living beings in a living world, mutually dependent on each other.

Figure 12.  
Papatūānuku | height map 30m, Kuku



Forster (2019) articulates beautifully that whakapapa transcends time and space to help us understand our contemporary relationships with all living beings, meaning that we inhabit a fluid, complex and diverse ecosystem and that it is through whakapapa that relationships between nature are explained, links between people and personifications are known and woven together. It is a Māori way of knowing how we are all connected.



## 2.2 A Whakapapa of Wai

Water is critical to life, every living thing is dependent on it not only as a basis of survival but also in its role in anchoring one's identity, wellbeing and sense of place.

In order to understand the Whakapapa of wai we must start at the beginning with the rupture created between sky father Ranginui and earth mother Papatūānuku.

Ranginui and Papatūānuku are the primordial parents that were once in a close and loving embrace. This embrace locked their tamariki tightly together between them in the darkness. Some grew frustrated at living in such confined conditions and longed for a world with light.

As the pūrākau goes, it was Tāne Mahuta that forced his parents apart and this parting formed the sky father Ranginui and the earth mother Papatūānuku. Ranginui wept, his grief presented as loving tear drops (rain) that fell over Papatūānuku creating streams and rivers that nurture and sustain. Freshwater therefore appears as a physical manifestation and direct consequence of this parting, understood as Parawhenuamea the personification of freshwater on land, connecting us through whakapapa to our

primordial parents. Our relationship to nature is heightened and experienced more deeply through personifications that forge emotional connections with wai and whenua.

**“The personification of a landform gives its tangible existence a wairua, making an ancestral maunga as much of a living soul as a human” (Hill, 2021, p. 43).**

Māori holistically view Papatūānuku as our mother, she heals, nourishes and nurtures. Our thirst is quenched with water, bellies full from kai grown in her rich soil. “Papatūānuku is loved as a mother is loved” (Walker, 2004). Likewise we grieve the desecration of Papatūānuku for what has been exploited, violated and disrespected. In May 2021, I attended a wānanga with iwi representatives from around Aotearoa concerning the translocation of tuna from Zealandia ecosanctuary lakes and into the Ōtari awa. Here I listened to other people's experiences of catching tuna and the mana associated in providing for whānau, observing tikanga and traditions, and sharing waiata and pūrākau across generations. During this experience there were profound moments

where you could feel the sorrow emanating within the room notably when discussing the depletion of taonga, paru (dirty) waterways and the threat of traditions dying. In that moment collectively we all grieved the state of Parawhenuamea.



Figure 13.  
Ko wai matou - we are water



## 2.3 Pūrākau

Pūrākau are narratives or stories that shape our understanding of the world, providing a means to layer stories upon each other as a way of sharing knowledge, values, history and protocols. They are “oral histories that can be seen simultaneously as data, and encoded knowledge, and a capsule of wisdom” (Mercier et al., 2012, p.112).

There are many stories related to the complexity of wai that encapsulates how we are connected, how different personifications represent different bodies of knowledge and have different meanings, or specify the characteristics associated though the naming of landforms.

A local example of this is the pūrākau associated with the naming of the Ōhau River. According to this pūrākau, Popoto and his wife Nanaia had a son called Haunuiananaia. Later in life, Haunui was a tohunga who embarked on a journey to pursue his errant wife Wairaka, naming many landmarks and rivers down the west coast towards Te Whanga nui ā Tara. At one point he climbed a tall mountain and upon reaching the top he sat down to rest. He named this mountain Remutaka, which translates

‘to sit down’. At day break Haunui arose and continued his journey south, coming across a river he named Ao Ōhau translated as the daybreak of Hau (Adkin, 1948).

Another pūrākau tells of a taniwha who lives in a bend in the Ōhau river known as ‘the deep’ (Smith, 2007). Taniwha are powerful beings or kaitiaki (guardians) and are in some instances considered protectors of waterways. They can signify and act as a deterrent to dangerous sections of the river or indicate an abundance of kaimoana (Patete, 2021).

Potteiger (1998) discusses in Landscape Narratives how narrative is a means of communication - like a language. The way we sequence events in order to construct stories becomes more meaningful. These stories shape our world, histories, myths and lived experiences and speak to our origins. They mark boundaries of what is knowable and explore the enigmatic.

The importance of pūrākau is fundamentally connected to both Spatial design as a practice, which seeks to visually communicate people’s experiences, knowledge, stories and lives. Likewise, Indigenous science is a body of

knowledge that can be transmitted through pūrākau (Lee, 2009; Ramea, 2011). Here, the story and the narrator work together to articulate and connect the past, present and future.

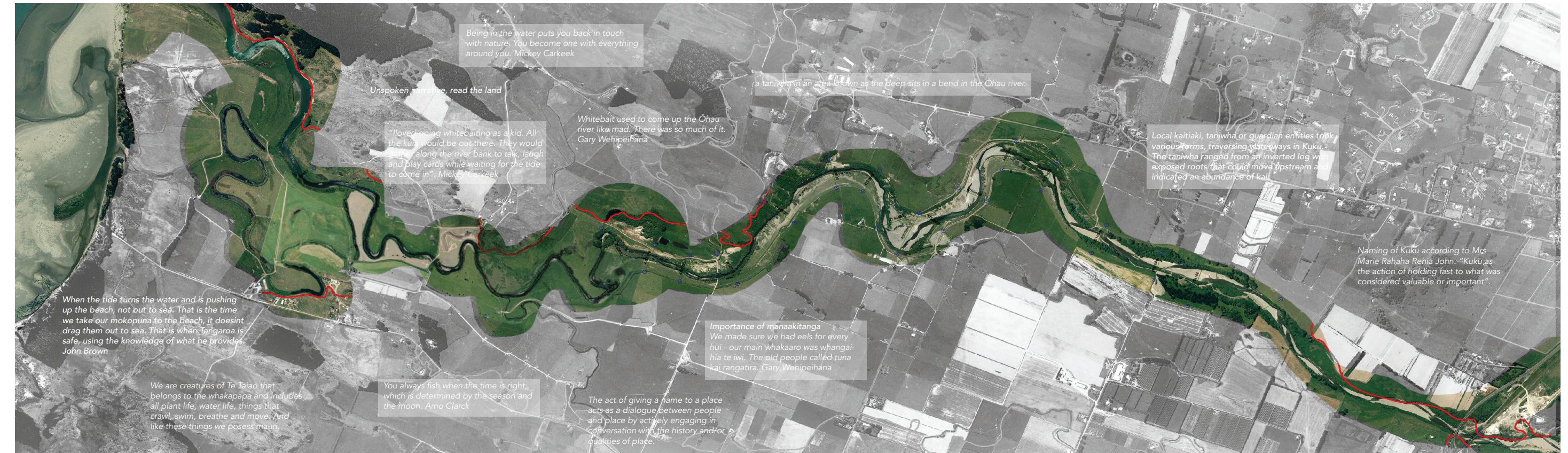


Figure 14. Pūrākau shared





Figure 15.  
Working with the whenua

## 2.4 Indigenous Science

Indigenous science is based on intricate and intimate observation and understanding the complex behaviours of our natural and physical world through trial and error. It involves paying attention to tohu (signs in nature), reading and understanding the cycles of the ebbing moon, syncing yourself to the natural rhythms of the passing seasons, movement of the stars, weather patterns, ecological and cultural systems, letting nature be your guide, navigator and teacher. Dr Rangi Mātāmua, in a recent interview explains that there is more than one way to understand something.

**“Empirical science is embedded at the heart of indigenous knowledge systems, the difference is that it is encompassed in a much larger cultural understanding and belief system. The reason that our scientific and empirical scientific knowledge is embedded within our cultural practices, reo, ceremonies and narrative is because it has meaning and purpose. That is how Maori connect”**(Mātāmua, 2021).

He goes on to discuss how this deeply rooted connection has also led to western practitioners of science to disregard the depth and richness of indigenous people’s knowledge as science.

**“They don’t see it as science. For example, Māori would look at a star, correlate it with the lunar phase, relate it to the sun’s position, a spawning fish species and a particular tree that is in flower. Māori would then remember these types of observations by putting it into waiata and embedding them into ceremonies. It would become part of their spirituality and connect the entire observation to a specific deity”** (Mātāmua, 2021).

This way of seeing how everything is interconnected from seasons corresponding to changes in the weather to recognising and adjusting to the varieties of soil types is fundamentally science. An indigenous knowledge that extends in connectivity to whenua and wai understands this to be a living breathing ecosystem that stretches back to our creation stories. What this indicates is the need for both indigenous knowledge systems and modern day science to work together instead of being adversaries. “Māori knowledge represents the body of knowledge which, in today’s society, can be extended, alongside that of existing Western knowledge” (Smith, 1999). Both knowledge systems must work together if we are to combat climate change and actively contribute to environmental rehabilitation.



present

Ko Ranginui kei runga,  
Ko Papatūānuku kei raro  
Ko mātou e noho ana  
Kei waenganui

With the sky above  
And the earth below  
How do we live  
In the space between



Figure 16.  
Hīkoi | we step, we stride, we walk



## chapter three

Kaupapa Māori methodology “stems from a Māori worldview, is based in epistemology, incorporates Māori values, knowledge, skill, beliefs and tikanga” (Bevan-Brown, 1998, p. 231). It is guided by relationships to the environment, a strong emotional and embodied Māori way of knowing that works with kaitiaki and is grounded in mātauranga Māori.

The use of a kaupapa Māori methodology also felt the most appropriate method to employ. “It responds to colonisation and its manifestation of power that has structured, and continues to structure Māori” (Bennett, 2015, p. 28).

Tuhiwai-Smith (1999) highlights how in this context it becomes a process of decolonising an imported research system that favors eurocentric led ideals as the norm, removing and dismantling control and authority that is inherent in research within an academic institution. It then promotes practical interventions and transformative practice enabling liberation to take place and challenges the locus of power and control over the research (Tuhiwai-Smith, 1999).

The methods applied have been drawn from wānanga/hui and hīkoi in collaboration with iwi and hapū to ensure this process is done respectfully with open and clear communication that contributes towards achieving transformative change, enriched with culture not devoid of it.

### 3.1 Wānanga

Wānanga is an intensive learning event. In present times it is likened to an expansive ‘workshop’. This method encourages close engagement with kaumātua and kaitiaki, with the knowledge of place, the kawa of the marae, tikanga and associated Māori relationships to the environment. Throughout this project I have been involved in four wānanga.

The first was an introductory wānanga on the 16th of October 2020, at Tukorehe Marae in Kuku, where I was immediately immersed in tikanga. As the only manuhiri, a pōwhiri commenced and I was welcomed onto the marae. After the whaikōrero, waiata and harirū we cleansed ourselves with water, to break the tapu, we then followed this encounter with kai.

The purpose of the hui was to introduce key stakeholders and outline the deliverables of the project. This wānanga provided opportunities to talk to some of the kuia to hear their hopes for the future, stories of the past and the politics involved throughout the process to date. I was also advised that this is where the elders size me up, to see if I’m up for the job. Having gone through the pōwhiri process through the marae

meant that I could go out on the land and be safe to do so. For any research projects in Kuku, everything goes through the marae and everything is grounded in kaupapa Māori.

On the 19th and 20th of November 2020 at our second wānanga, this included representatives of iwi and hapū, members of the community, representatives from the Ministry for the Environment, Department of Conservation, climate change researchers, water specialists, experts in coastal processes and ecosystem services as well as local government officials. All were specialists in their fields and all of us in the kete.

On the first day we observed a presentation on freshwater ecology and natural ponding systems as an implementation strategy to building farm scale resilience. Kōrero took place around design considerations that might minimise flood risk and create a diverse native wetland environment, with predator control including ways to action this mahi without high cost. We reflected on the discussions over kai and when our puku were full we walked the whenua.

The night of the 19th, we attended the Mana Moana Digital Ocean Experience where a compilation of 20 artists from around Aotearoa displayed digital artworks that took place over an immersive waterscape, offering compelling narratives that spoke to our relationships to wai in ephemeral but powerful ways. The second day started with a presentation on climate impact and hydrology predictions. The river was then profiled whilst the rest of the group gathered to reflect on some of the outcomes and next steps.

A lot of key information and expertise was shared over these two days from exploring and ensuring interconnectedness between all entities and understanding how this research is fed into a Māori-led climate change implementation plan that helps transition coastal Māori communities to water based land uses and enhancing taonga species.

The third wānanga occurred over two days on the 15th and 16th of July 2021, at Dr Huhana Smith's whare in Island Bay. This was primarily a data-focused hui. Dr Christian Zammit shared his global, national, and regional hydrological modelling data, at temporal scales from the past (1986-2005) to forecasts into the future (2121).

Dr Rebecca Eivers shared her site specific data from the Ōhau River and wetland areas, including hydrology (affected by lunar cycle and rainfall), water chemistry, fish, plant and invertebrate ecology, specifically looking at the life cycle of whitebait including īnanga and kōkopu species.

My contribution came in the form of creative and visual storytelling of mātauranga Māori, the

history, kōrero tuku iho, local stories of place, and traditions of the past, present and future. We discussed how we can design wetland habitats that connect with people emotionally and still showcase the reality of climate change through scientific data.

Together we cross-checked information, identified rainfall, river flows and discharge collaboratively drawing on large scale print outs of maps to locate where data loggers were on sections of the Ōhau River 'Loop'. It gave me the opportunity to really understand what each person is bringing and for myself to initiate ideas as to how to translate this complicated data into a spatial experience that resonates with key shareholders. We then focused on what deliverables needed to be achieved by

the final wānanga and how we will collectively present as one.

The final wānanga took place on the 7th of October 2021. This was changed to an online hui due to COVID-19 disruptions. Two separate presentations took place over the day. Dr Christian Zammit, Dr Rebecca Eivers, Dr Huhana Smith and myself revealed the first presentation to the Tahamata shareholders and farm board members as a tirohanga whakamua (visioning session for futures). This specifically addressed how they could work with us to adjust and adapt to more water being present due to climate change on their coastal farm, and for enhancing taonga species for their mokopuna and te taiao (wellbeing of future generations

and the environment). We identified the outcomes from the mahi and addressed what needs to be actioned now, emphasising how the board's help is crucial for instigating next steps.

The second presentation required a few changes as the audience altered to local and regional councils. Here, I shared further development of my Masters project in more detail demonstrating the innovative opportunities provided through design as a way to communicate the woven narratives translated through digital applications and immersive environments.

The shift to an online hui meant adapting how we communicated and visually presented in a way that still translated the data and

enabled an emotional connection through spatial experience digitally without being on the whenua in Kuku. This shift initially felt like a big disappointment, but upon reflection also provided an opportunity to reinforce the thinking behind this thesis and the importance of being able to communicate and connect people through Spatial design.

The feedback received from both presentations was positive. Iwi and hapū members raised questions around what is required from the board to get things started.

One board member who was new to this type of information commented that they could immediately see what the future holds and why implementing adaptation is necessary and

offered to pass on the information to members that could not make the hui, acknowledging the importance in what had been presented. They added that it was sobering and honest, a lot to digest, but beautifully presented.

My work was acknowledged in relation to the varied media use that explained and simplified difficult concepts, the visual presentation that particularly emphasised adaptive design visualisations and the overall flow and communication. Potential future collaborations were discussed, particularly with regards to elements of my design being injected into other research projects.



Figure 17. wānanga | our embodied experience





Dr Huhana Smith after the presentation commented on her need to drive home to Kuku that night to bathe and be immersed in Kuku water, a calling back to whenua perhaps.

Overall the feedback acknowledged that we all presented with meaningful, creative, and practical alignment of four different specialties. We worked together to produce an adaptive, instructive, and considered solution and strategy to climate change challenges, with the aim of implementing transformational change that respects diverse knowledge, practice and showcases the collective power of communities.

Figure 18 & Figure 19.  
series wānanga | series zoom hui





## 3.2 Hīkoi

The translation of Hīkoi from the Māori Dictionary is: To step, stride, march or walk. But it is so much more than this. Below is a reflective text that I wrote based on my first hīkoi with iwi and hapū, researchers and government representatives.

**Our puku are full, excitement is stirring, as we don our jackets and boots. Bodies pile into cars, us 12. A quick exit across State Highway one, never an easy feat. The Tararua ranges that sit behind the marae pat us on the back as we depart. A slow and short drive west. Our starting point. Kuku beach. Together we gather and walk and as we walk, we talk. This is hīkoi**

**The Tasman Sea greets us, it's high tide a mamaku tree has washed upon the shore. Erosion. Everywhere. Dunes dissolving, roots exposed. Wai flows over, laps against the land my boots already drowned.**

**The Karoro swoop above their breeding grounds near, the crunching of the driftwood underfoot mingling with their chatter.**

**Over folding landforms, we stroll, the unexpected sweet smell of gorse piercing the deep scent of soil. The Ōhau River bounded to the north in our sights. Destruction, the human kind. Kōtuku Ngutupapa shot dead. Her body is wrapped, taken and cared for. Tohu – signs the whenua is in conflict, a cry for help. Parawhenuamea reclaiming her position pooling, seeping, stirring from below.**

**Stories retold of growing up on the land, memories relived of catching kai, providing for whānau, evoke a sense of sorrow for what has been lost. This richness of oral history, stories, cultural sites, burial grounds and markings of time their importance washes through us all. Absorbed. This is hīkoi.**

Hīkoi as a methodology in this process of engagements was critical. This approach provided first hand knowledge, understanding and sensory experience of the beauty, complexity and dynamic qualities of the whenua, the coast and the awa, including the mauri or wellbeing of the site.



Figure 20.  
Hīkoi | over folding landforms

Together we walked, taking in the state of the whenua and wai, listening intently to the stories and histories. Seeing, sensing and feeling both in our collective connection and intimate relationship to the site.

As we walked, we talked of what it means to re-engage with the natural world, acknowledging the ecological decline issues, hard not to when you are confronted with them lapping at your feet. This also brought up discussions about potential systems that could provide restoration, environmental narratives to regenerate or in some cases reclaim.

Doing this alongside iwi and hapū provided a deeper understanding of the sense of loss and why this mahi is so important. In this moment, I understood and appreciated the interconnectedness between nature and human nature and how my part is to be a continual learner engaged in understanding and translating this synergy. One iwi member prior to our walk said to me “You will walk out onto the land, and the land, it will speak to you and you will either feel it, or you won’t”. I definitely felt it.





### 3.3 Kōrero Tuku Iho

Kōrero tuku iho can be understood as knowledge transmitted down through generations defined as past, present and future, oral narratives that build upon whakapapa understandings.

They are narratives that provide a lens to establish the physical and spiritual associations between land, waterways and peoples. This methodology has been incorporated throughout this process. From the informal conversations had with iwi and hapū over kai sharing their cultural memories, discussions about the current state of the cultural landscape and its decline, to aspirations for the future that actively revitalise the current fragmentation of ecosystems and what that would mean for future generations.

Figure 21 & 22.  
Hīkoi | together we walk and talk



# chapter four:

## 4.1 Grim Realities

Science deals with the explicit, analytical and uncontested assumptions of objectively measured things. The evidence! A key distinguishing feature of Western science is that it sets out to, weigh, measure and otherwise quantify (Huxley, 1958). It is a “systematic means of producing knowledge” (Mercier, 2007, p. 23).

Environmental research has and is being compiled, data collected, collated and measured with the statistics drawn up into bar graphs and climate model predictions decoded through pie charts. Essentially we are being told by scientists that the threat of our climate crisis is reaching catastrophic proportions including extreme events from heat waves to flooding, fires to droughts, you only need to watch the news and something is happening both globally and in Aotearoa. In reality “It is unequivocal that human influence has warmed the atmosphere, ocean and land” a statement made by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change, released in August 2021. Due to ongoing deep heat uptake and mass loss from polar ice sheets, the global mean sea level will continue to rise beyond the year 2100 (Oppenheimer et al., 2019).

Aotearoa, being an island, will feel the effects of this dramatically with coastal flooding more commonplace, and as previously mentioned this will exacerbate other problems such as coastal erosion and depletion of taonga species like tuna and inanga.

Based on Sea Level Rise predictions, most of the land in the Waikawa to Kuku coastline in Horowhenua will be permanently inundated. As indicated in Figure 23 there will likely be a 0.5 metre rise in 20 years, a 1.5 meter rise in 50 years and, in a worst case scenario, a 3 meter rise in 100 years.

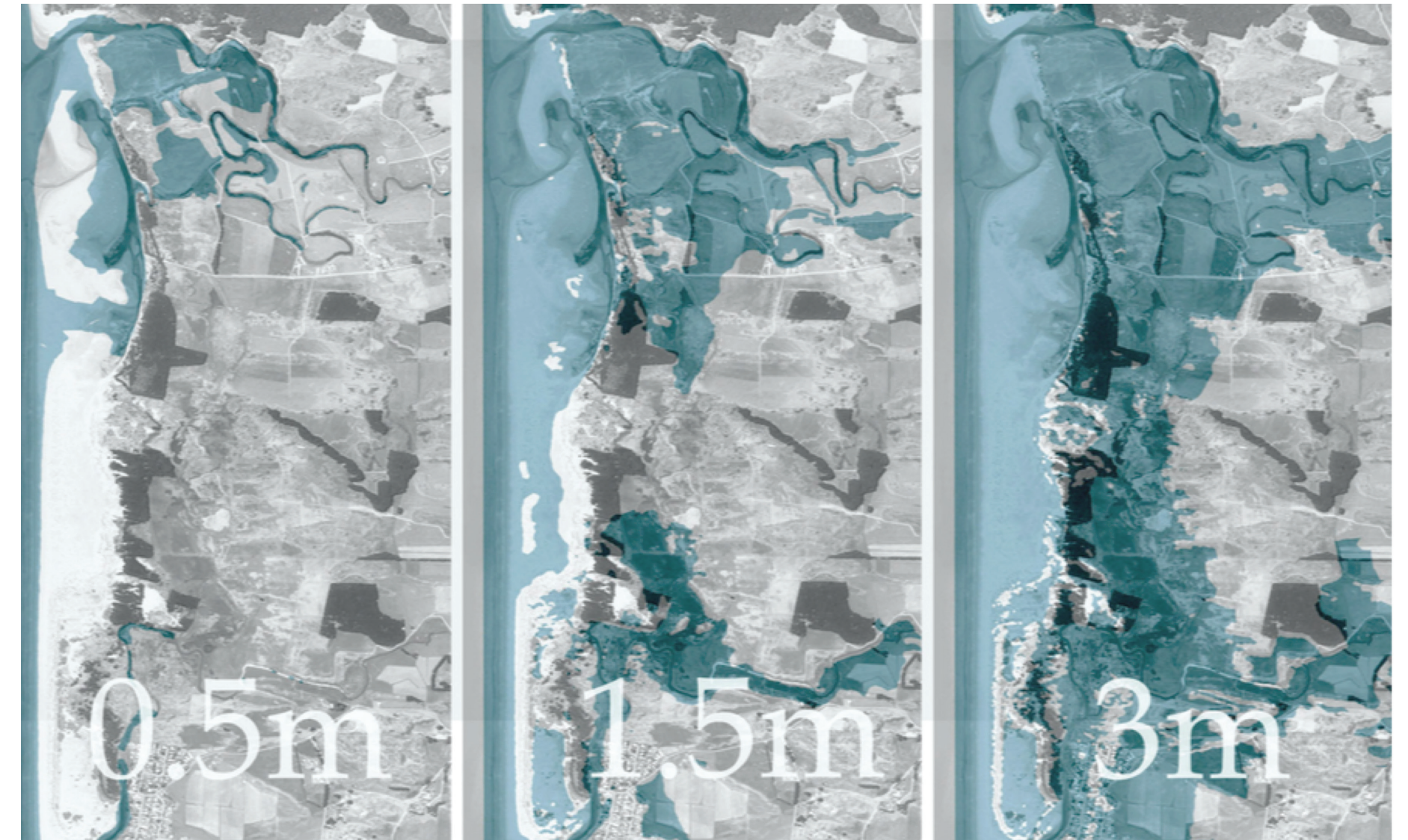
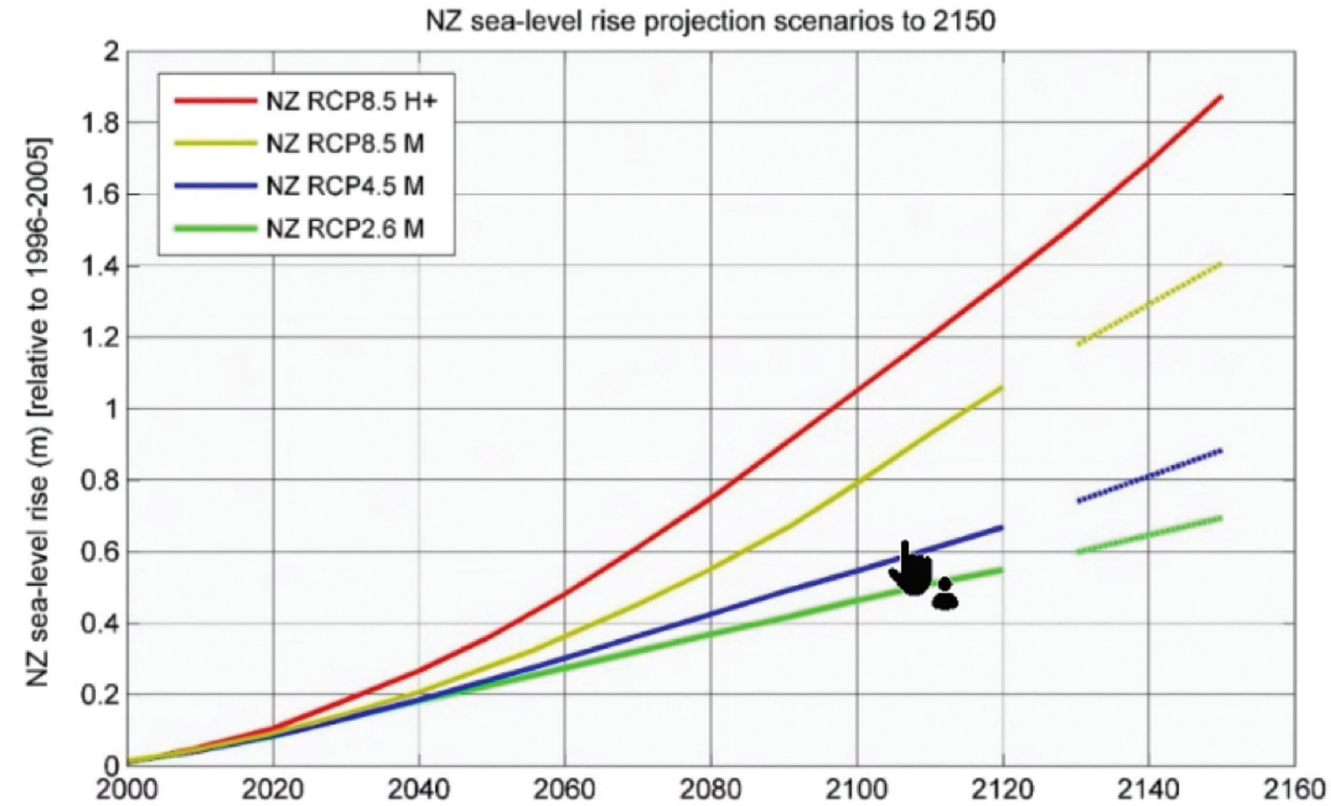


Figure 23. Sea level Rise| summary of predicted rise



Figure 24.  
NZ Sea level Rise | projection scenarios



With the existing shallow gradient of the whenua this will have disastrous implications on our coastal communities (Allan et al., 2017), which will affect Aotearoa environmentally and economically with buildings, facilities and infrastructure such as transportation links, water, electric and sewage systems being impacted.

According to the coastal risk exposure assessment by the National Institute of Water and Atmospheric Research (NIWA) approximately four percent or 178,000 of the coastal resident population of Aotearoa will be exposed and displaced. If we do not start implementing change by reducing our greenhouse gas emissions things will start to look very grim. “We will be faced with overwhelming problems, our future will be miserable and the next generations will be dealing with the consequences” (Renwick, 2021). The problem is that it can be difficult to engage with science and perhaps easier to disregard it.

## 4.2 The Problem with Science

Ciphering through scientific reports stacked with a multitude of graphs, tables and charts can confound, mislead, and after a while blend into each other, As Renwick (2019) points out, “Science is all about numbers, facts, and graphs but not everyone is interested in this kind of information”. Overwhelming statistics and figures can feel psychologically distant and impersonal, for example

**“In 2019, atmospheric CO2 concentrations were higher than at any time in at least 2 million years (high confidence), and concentrations of CH4 and N2O were higher than at any time in at least 800,000 years (very high confidence). Since 1750, increases in CO2 (47%) and CH4 (156%) concentrations far exceed, and increases in N2O (23%) are similar to, the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years (very high confidence)”(Masson-Delmotte et al., 2021).**

Despite this statement delivering some immense changes in our environment it still feels distant and detached. This is because abstract images and facts, though crucial to recognising and understanding the issues, seem spatially distant occurring 14,262 km away in the Arctic, or far away in time occurring in the year 2100. We also have our own ingrained world views to overcome and disinformation operates to undermine people’s understanding of the science behind climate issues. These all become barriers that enable avoidance, removing us from the inevitable realities and impeding our ability to engage in climate change action.

How we talk about climate change becomes another obstacle. A jargon heavy ‘communication failure rooted in language and ideology’ (Hassol, 2015). What this emphasises to me is that the importance held in the data is not understood or communicated in a way that will generate transformative change.

The type of change that creates a deep structural shift in the way we view the

world, shape our behaviours or incite action. Indigenous knowledge assists in solving part of this problem by understanding the world holistically and acknowledging the influence of things that cannot be measured, things like mana and mauri (Mercier, 2007).

But how can we move to make the invisible visible and the intangible tangible?

Figure 25. Hydrological model for Ōhau River | temperatures

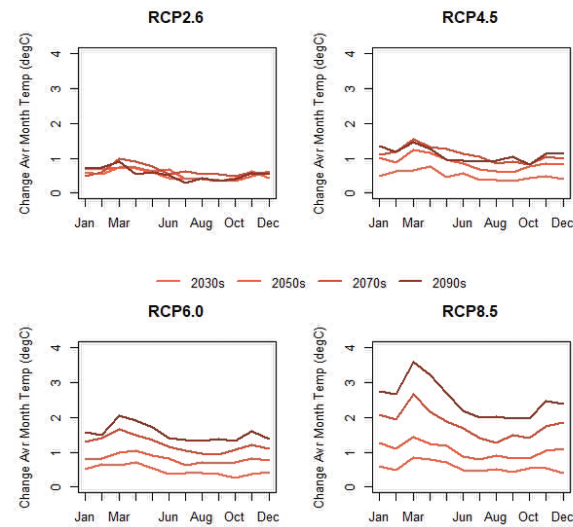


Figure 26. Hydrological model for Ōhau River | rainfall

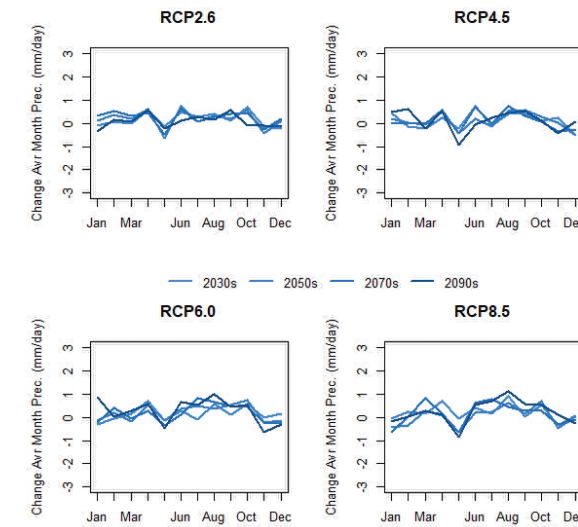


Figure 27. Hydrological model for Ōhau River | evaporation

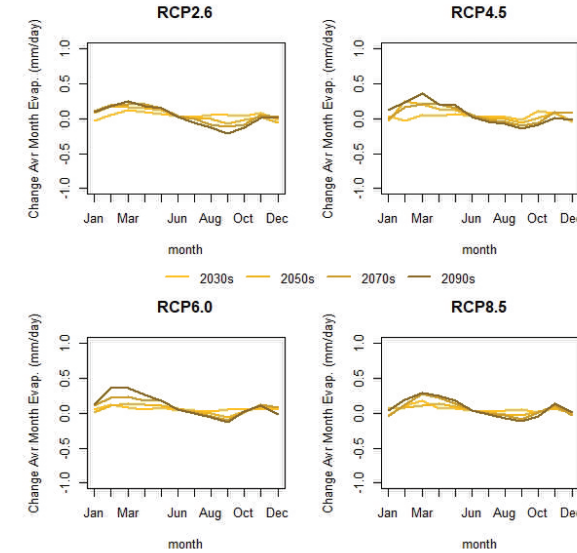


Figure 28. Hydrological model for Ōhau River | discharge



### 4.3 Visualising Science

Complex systems within the western scientific community have successfully been visualised to capture the facts and details that prove a hypothesis and communicate information comprehensively. These can also be inherently understood spatially.

In 1953, James Watson and Francis Crick became the first scientists to formulate an accurate description of deoxyribonucleic acid's complex, double-helical structure (Pray, 2008), assisted by the x-ray crystallography images of Rosalind Franklin, which offered a way to see molecules through x-ray beams that create a diffraction pattern. This pattern acts as a list of coordinates, dots in space deciphered by interpreting lengthy calculations.

Using paper model cutouts that represented the individual chemical components, Watson and Crick physically shifted molecules around combining them in different ways to form link bonds, putting the pieces of a puzzle together until the final visualised structure was solved. This transformed a complex molecule into a three dimensional spatial model that could be clearly understood.

This is a communication tool that is now highly recognisable and provides important information crucial to understanding our genetic structure and the importance of DNA to life and health. Science can be spatially visualised to make the invisible visible, assisting our ability to comprehend complex information.

I argue that it also needs to connect with people emotionally. I propose that science, when told through spatial narratives, has the power to touch minds and hearts. Connecting with people's emotions, acknowledging that we are part of something bigger, which is what Indigenous science achieves by orienting one's sense of place and time as deeply connected.

Indigenous science and western science in combination with Spatial design too, can address and synthesise distinct knowledge systems and use data to uplift knowledge to be better understood and felt, even when it is unseen.





# future

“We must tune in to our ability to see beyond the physical reality that surrounds us, and awaken to the vast unseen world that exists. Then we can begin to see beyond sight and to hear beyond sound. We see the underlying structures that support our world, and life begins to take on new shape, new meaning.

When we take on this role as multisensory beings we find that we are able to comprehend the language of living things”.

(Mitchell, 2018).



Figure 29.  
Wai



## chapter five:

Spatial Design defined by Massey University is the 'practice of imagining, forming and constructing spatio-temporal environments'. It 'explores the corporeal and theoretical conditions of environments and events, offering opportunities to rethink built and virtual spaces in ways that are innovative, speculative, and mindful of the wellbeing of people and the planet' (Spatial Design Website, 2021). I elaborate on this in that it breaches into other fields of design, allowing us to understand not just the design of a space or how it is constructed, but how it shapes experience and contributes to the stories of people's lives. With this understanding, spatial designers have the ability to improve environments in ways that impact lives. In this project, this materialises in the form of spatial design as a translator communicating predicted outcomes of climate change and integrating mātauranga Māori alongside scientific data. But also, it proposes Spatial design as a facilitator in catalyzing transformative change through the use of immersive and atmospheric environments connecting people and data.

### 5.1 Narrative as Story

"We live within worlds of stories, and we use stories to shape those worlds" (Potteiger, 1998, p. 3). Stories permeate our lives, expanding edges and boundaries giving form to transient experiences. They speak to our history, cultural traditions, lived experiences, extend our thinking and enhance our understanding of complex issues.

Stories assist in creating connections to people, place and time through the extension of the body. Maurice Merleau-Ponty (1962) is a phenomenologist who discusses a theory of embodied perception, whereby we think, feel and narrate through our bodies. "I am not in space and time, nor do I conceive of space and time; I belong to them, my body combines with them and includes them"(Merleau- Ponty, 2011, p. 140). 'Narrative is a means of communication that expresses how the story is told and represented, it is both the process and the product central to understanding the story' (Potteiger, 1998).

The use of chosen visual communication methods employed in this project include embodied visualisations, augmented reality (AR) and virtual reality (VR), with the way in which elements have been presented also adding to the understanding of the story.

In these narrative environments, stories are embedded in and expressed through methods fundamental to creating atmosphere like form, materiality, light, colour, sound as well as consideration of the journey itself. Pallasmaa suggests that the atmosphere is generated through a series of multi sensory functions that when fused together form an overall mood, a multisensory experience (2014, p. 230). We read space, we shape space, we create our own stories through space. A space is seen, felt, heard, vision alone is insufficient to address how bodies sense spaces and their atmospheres (Bohme, 1993).

Our environment is already infused with meaning and it is through our whole bodies, not just our eyes, that we intellectually, emotionally and sensorily respond, connect and interpret spatio-temporal environments.

**"We come to know a place because we know its stories" (Potteiger, 1998, p. 6).**

Growing up, I recall returning to our wharenuī in the Wairarapa for tangihanga with my mum. A wharenuī embodies principles of connection and narrative. It is a spiritual entity conceptually representing the body of an ancestor, a sacred space. Consciously woven, painted and carved

into the bones of the whare is the whakapapa of our people, reaching back to the origins of creation, a library of information and stories about people and past events.

I recollect a series of different experiences that have somewhat merged together over time. Walking across the threshold of the ātea feeling apprehensive and uneasy, even at a young age, I remember the air feeling thick but not due to the weather. Just before entering the wharenuī where we removed our shoes, I recall being confused by the sounds of wailing mingled with soft chatter and laughter, a cacophony of emotions filling up the space. Upon entering the belly of the wharenuī, being confronted by a sea of faces, with our whānau from near and afar seated around the perimeter of the room, I remember looking around at what seemed at first a very dark space, observing a gallery of photographs of those passed adorning the walls and carved whakairo of our ancestors holding up the backbone. This is a space that evokes emotions, where the atmosphere is palpable, hovering in and around us experienced by our sensory body. "My body is the fabric into which all objects are woven"(Merleau-Ponty, 2011, p. 235). I can't recall the exact moment the ambience shifted but after a time the whare became warm, comfortable and filled with more

stories, connection and laughter. There were still moments of tension and tears held within the stories shared but the space had been altered or perhaps our bodies became instruments that soaked up the atmosphere that surrounded us like an invisible embrace. Our bodies, no longer on the periphery but entangled and fused within the tangible and intangible embodied experience.

## 5.2 Spatial Design as Translator

Throughout this process I have worked within a kete of people committed to understanding future scenarios of climate change, to implement adaptation strategies, protect treasured ecologies and to translate this mahi in meaningful ways through the use of Spatial design. I have listened, observed, understood, interpreted, learned, engaged and delivered the mahi to assist in taking action. Below I have pulled out a series of examples where spatial design has taken the role of translator, these were built into the wānanga described in chapter three.

### Beginnings

**“Following a path and discovering a path of our own, wandering, strolling, being seduced” (Zumthor, 1998, p. 86).**

**Kaupapa** is a compilation of video, images and information that shares our experiential spatial journey together highlighting our kaupapa Māori methodologies, starting with hīkoi following the landforms of Papatūānuku.

We are directed in and out of framed moments, observing how the water flows over, seeps and pools, becoming these black boots that negotiate her curves.

The focus of the images changes and the tempo slows. We see the destruction caused by climate change and its insidious beauty as even though erosion is destructive, it still manages to reveal the fragile root system once hidden. We then move to the sharing of knowledge where science and mātauranga converge.

Throughout this video the soundscape changes, subtly shifting in volume and speaking to each moment, fusing the crunching of driftwood underfoot, lapping of wai, birdsong, crying and stories shared by iwi and hapū, in an attempt to reanimate the mauri of the whenua.

**“Listening is multidimensional. It enfolds us in space”(Sember in Hirsch, 2012, p. 124).**

The visual journey shifts to our embodied experience of wānanga, encapsulating our ‘workshop’ environment including the process of sharing, empowering and generating knowledge. This compilation seeks to absorb the viewer into the process of engagements that are critical to understanding how knowledge from western science and mātauranga has provided a deeper understanding and emotional connection to whenua and wai.

Kōrero tuku iho and pūrākau were then shared, connecting to the past by extruding narratives of memory and understandings of how we came to be. Being in the present elaborates on how everything is interconnected and dependent on each other. Scribed into the images of the whenua were the lines of whakapapa embedded alongside a series of videos of flowing water and toitoi swaying in the wind. Speaking to the wairua, forming a conversation, an exchange and search for guidance. “Orientations, movements, impressions and markings... create spatial concentrations, directions and constellations’ (Bohme, 2017, p. 75).



Figure 30.  
Kaupapa | stills



## Tensions

Dr Christian Zammit presented his findings of the latest scientific hydrological data alongside my constructed 3D spatial visualisations that changed depending on what was required, and what best represented and explained the data.

This portion of our presentation held a lot of tension as realities became clearer to all entities. An example of this is when the sea level rise projection scenarios for Aotearoa was introduced through a graph as seen in (Fig 24.) Adjacent to this graph I created an animated 3D spatial environment using a combination of design programmes including Twinmotion, which is a 3D immersive visualization software that produces high-quality images, panoramas and videos that offer atmosphere and ambience.

To create my immersive environments I experimented with dynamic time-of-day simulations, ambient shadowing from volumetric clouds, reflections and exponential height fog allowing more control over the properties of fog including density and colour. I aimed to evoke a sense of urgency and awareness lingering in the air, setting the tone of what is to come. It is an overcast day, clouds are forming and light is filtered through the fog that is rolling in. A woman stands watching, a

soft light still allowing the ability to see clearly out to the horizon but also providing a slightly eerie feeling. This image is located at the mouth of the estuary, a very distinguishable location, adding an emotional connection through context. These tools were used to create a moment that looks to the future and communicates the impact of the sea level rising over the next 20, 50 and 100 years as per the predicted scenarios. The progression of water enveloping the whenua exposed through the animation enhances the tension held in the line graph and the reality being discussed within the data. This immerses the viewer in the uncertainty of climate change and how sea level rise will impact this rohe.

Figure 31.  
Protect coastal dunes



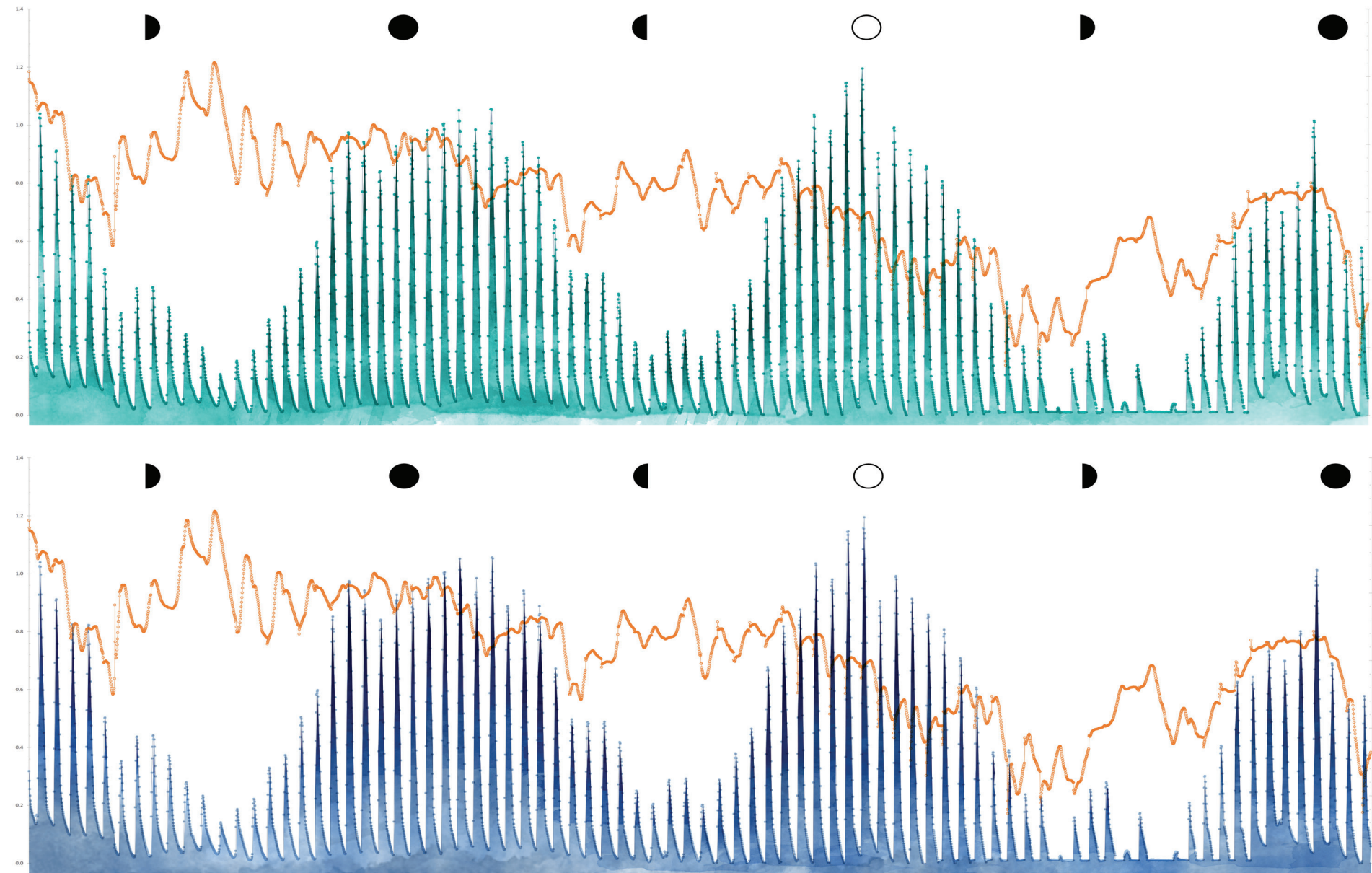


## Explanations

Dr Rebecca Eivers then proceeded with a strong focus on the ecology and the wetland habitat ponding system. To visually articulate this portion of our story I used a series of different tools, one being the incorporation of a graphics interchange format (Gif) of the maramataka and next to it I composed a running series of graphs. These graphs were generated by Dr Eivers and showed the measured water depth for the Ōhau River and back water wetland.

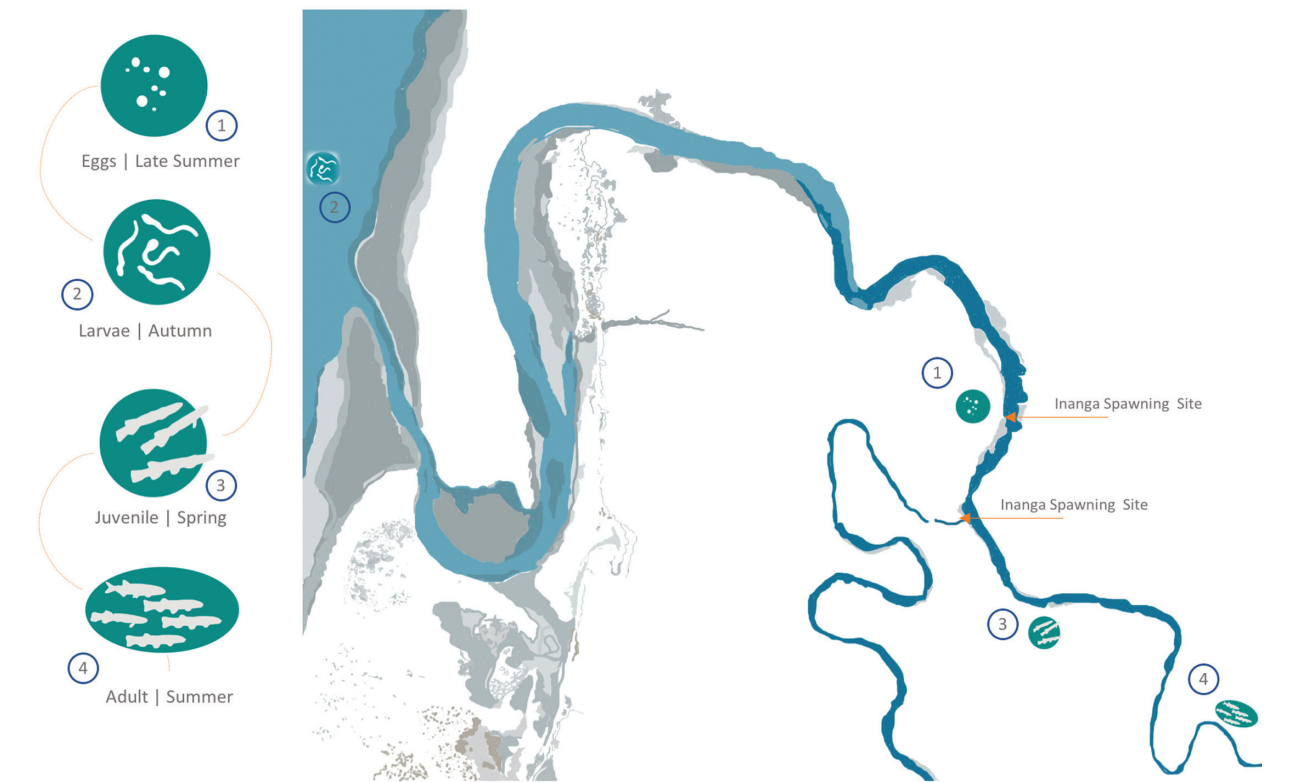
After conversations with Dr Rebecca Eivers I adapted these graphs slightly by adding colour, specifically the colour of water that filled up the lower portion of the graph, which assisted in clearly indicating differentiations of the bodies of wai. Green related to the back water wetland and blue indicated the true left bank of the Ōhau River. This graph moved alongside the lunar cycle, which strengthened the understanding of how the changes of the maramataka affects the tides, combining both indigenous and western science visually.

Figure 32 & Figure 33.  
Backwater wetlad | True left bank of the Ōhau River.



I also used a Gif with simplified diagrams and video as effective tools for synthesising scientific evidence that showed how the design was in tune with the life cycle of īnanga and how our design needed to be positioned at the 'sweet spot' where the salt water wedge meets the fresh water maintaining the interface to support spawning.

Figure 34 & Figure 35  
Gif of īnanga life cycle | Location of īnanga spawning sites





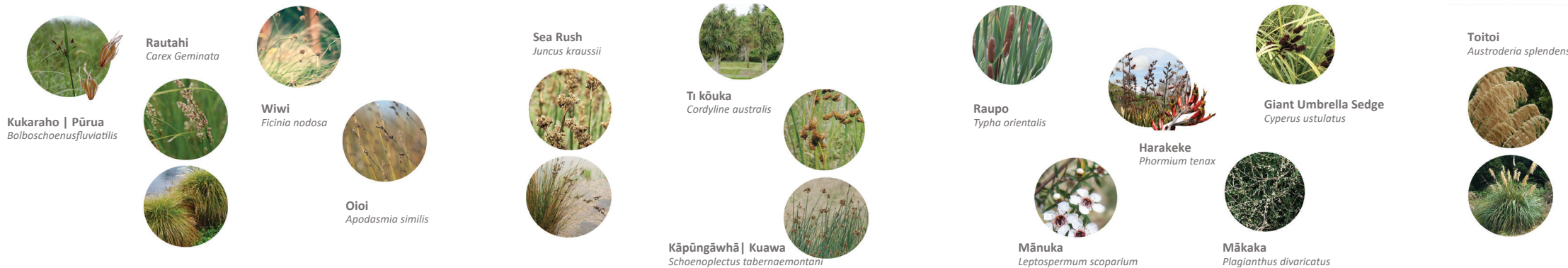
## Wetland Design

The location of our wetland habitat ponds were based on the predicted hydraulic outcomes of Dr Christian Zammit and measured findings and ecological knowledge provided by Dr Rebecca Eivers. I used a variety of images that displayed technical considerations and atmospheric qualities intended to capture the beauty and explain the design.

There is a large atmospheric section flourishing with native birds and fish indicating the benefits of riparian planting and systems such as the floating treatment wetlands. This section contained small pockets of digestible information like how they “remove nutrients and fine particles from the water by entrapment and uptake via the plants root systems” (Eivers, 2018, p. 215).

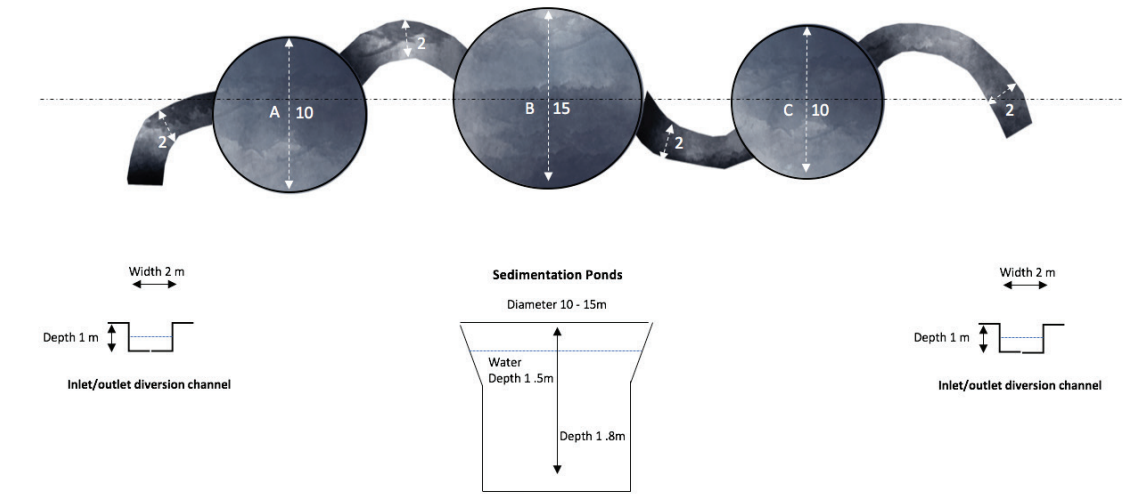
The planting plan included both the Māori and scientific naming of suggested native plants as well as how they are positioned so that shade would be provided, helping to cool the water and shelter aquatic fauna.

Figure 36. Section of wetland habitat ponding system.



Schematic drawings illustrated how this wetland habitat system is designed to suspend sediment from watercourses, transporting agricultural runoff for the purpose of reducing sediment accumulation in downstream water bodies through inflow and outflow channels. Next to these schematic drawings, images provided by Dr Rebecca Eivers of her previous work outlined step by step the earthworks process, which appealed particularly to the farmers.

Figure 37. Schematics of wetland habitat ponding system.



An animated flyover plan showing the three ponding modules was also included and intentionally framed as if we were manu (birds) finding a spot to land amongst the trees (Fig 38). Different scales were used with additional plan views highlighting placement and location. Through a series of full screen immersive perspectives, I portrayed how adaptive actions of resilience can contribute to alleviating the effects of climate change by protecting sensitive plant, shellfish and shorebird biodiversity on the coast, diversifying farming practices and enhancing knowledge of Inanga habitat.

This drawing set was important in enabling readability of the design using schematics and sections as well as embodied perspectives, key drawings for most design projects. The visual language conveyed throughout maintained its atmospheric qualities consistent in generating an emotional connection.



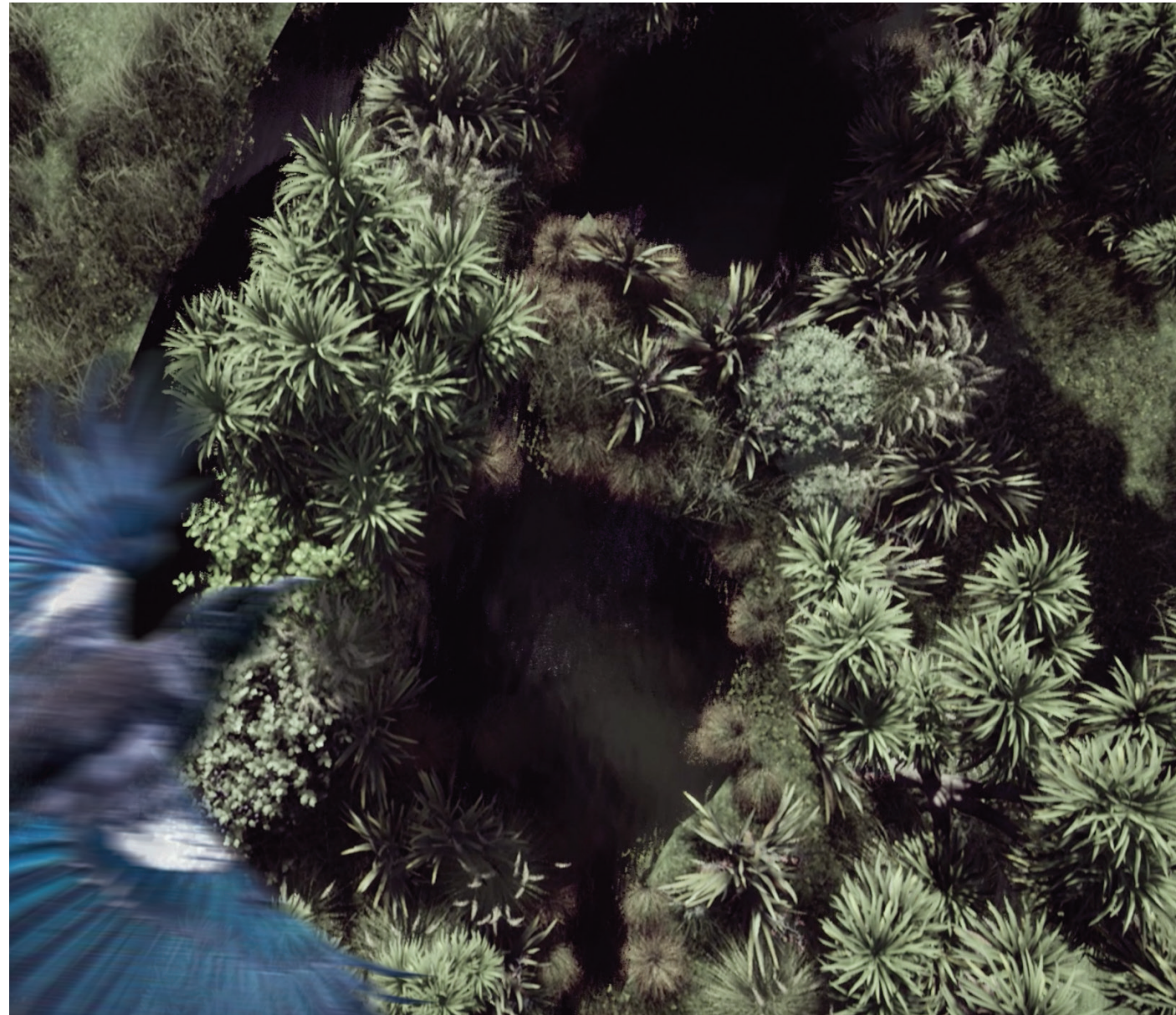


Figure 38.  
Flyover wetland habitat ponds



Figure 39.  
Recreating wetland habitats



## Innovation Using AR

Once the design had been presented, I then proceeded to discuss how I have been experimenting with Augmented Reality (AR), which is an enhanced, direct or indirect view of a physical, real-world environment where digital information is augmented by computer-generated sensory input such as sound, video, graphics or GPS data and seen

through a device like a smartphone. It is through this digital application I see opportunity for innovation. Styly is one creative platform I have been exploring as it is capable of publishing and distributing AR content. Currently in the whenua we have water loggers and other tracking devices that are receiving a live feed of data, essentially reading the whenua

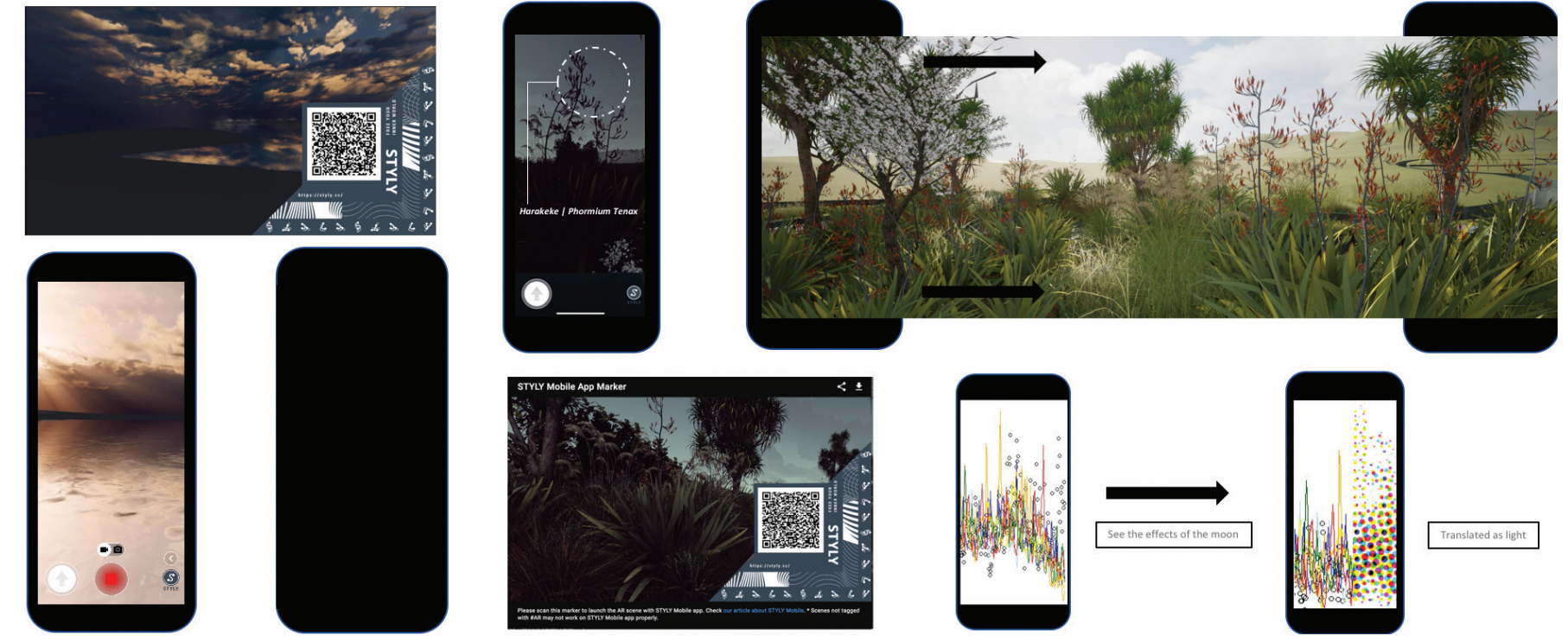
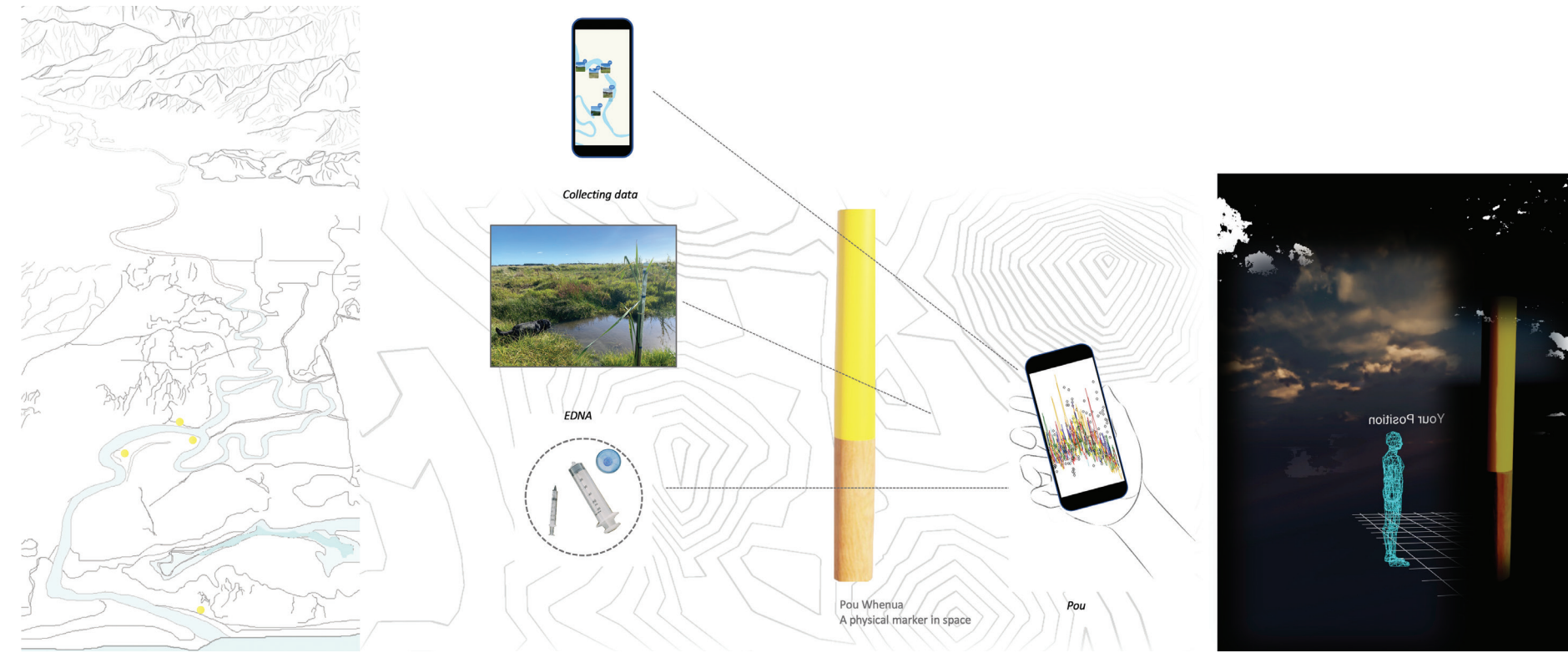
and wai providing critical information to the scientists about the site. I proposed the use of Pou Whenua being placed at these points of reference, becoming beacons of information.

Pou themselves are considered boundary markers that symbolise territory or places of significance, physical markers in space

that can potentially become hybrid objects physically embedded and located on site. The Pou whenua also contains a digital element like a designed QR code that transports you to an augmented environment taking place in the past whilst standing in the present or, standing in the present looking to the future. a way of connecting people through narrative

communicated through the digital device in hand. There is the potential ability to transport the viewer independent of being physically on whenua or digitally positioned on whenua. Pou also becomes a part of tikanga, a place to initiate karakia as well as providing the opportunity to layer understandings of the history of place, the markings of time and

pūrākau, embedding knowledge acquired through lived experiences, facilitating understanding of the maramataka, whakapapa of plants, and stars alongside the solid flow of numbers. This weaves climate change science, ecologies and mātauranga Māori through spatial constructs within the AR realm.





For example, when standing in the present on whenua and positioning your phone up at a plant this will then pop up providing information like its Māori name which is Harakeke, English name: Flax and its scientific name: Phormium tenax but then the pūrākau associated with this plant starts to play through audio/ oral narrative. Dr. Huhana Smith explained to me on our first hīkoi how harakeke represents whānau or family cycles. The rito (shoot) is the child and sits at the heart of the plant. It is protected by the awahi rito (parents) then the outside leaves represent the tūpuna (grandparents and ancestors).

Another example is when standing in the present and holding your phone up at an area that is currently a paddock, you can observe the past. As you move your phone around, suddenly you see large ti kouka, totara, kohekohe, matai surrounding you and a small walking track that leads to a papakāinga in the distance. Within this there are other exciting opportunities that I have only really started to test.



Figure 42.  
Innovation AR | harakeke

The Pou whenua located in the backwater wetland reads the data as a series of numbers measuring the discharge (Qm<sup>3</sup>/s) which shows the volume of water flowing per second.

**“Discharge is really important for understanding the flow and the river and flooding impacts and also droughts” (R.Eiers, personal communication, September 20, 2021).**

In April 2021 this was recorded at 3.97 cubic meters per second and in May 5.6 showing a big jump within a month. I proposed this increase in the data could be shown through light. For example you hold your phone up and the numbers are translated into a series of dots that disperse from the pou whenua at the measured speed of 3.97 and increase in speed 5.6.

Or the colour temperature of the light becomes brighter indicating the shift. Alternatively waiata could also translate this information, as the water increases to 5.6 (Qm<sup>3</sup>/s) we hear the crescendo that levels off in a high G sharp identifying through sound the incline recorded in the data and translated into song.



## Innovation Using VR

The use of Virtual reality (VR), which is: an artificial environment experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment (Merriam-Webster, 2021). This is an area that I have also explored, where I generated an environment enabling the ability to interact with projected future scenarios if adaptation strategies are implemented. Unfortunately due to being converted to an online wānanga the full experience was not demonstrated. However I adapted the use of this environment and recorded a video walking through the wetland habitat ponds at different times of the day. Here is a reflective text generated from one video.

Figure 43.  
Innovation AR | looking to the future





Figure 44.  
Protecting taonga species

**I stand, grounded, my feet burrowed into the outermost layers of Papatūānuku. Planted into the home of millions of microorganisms. I am rooted to the source of life and nourishment. The whenua. It's a calm and seemingly quiet day, I breathe in. My lungs filled with air, the interface with Ranginui. Wrapped, in his infinite yet fragile skin, thinner than the skin of an apple when compared to its diameter. Though within this fluctuating film all of life is protected and held. The piercing chorus of cicada, awakens me to the dry heat. Tamanuiērā sits high, my skin exposed. Tāwhirimātea thankfully sends a cool breeze. The Ōhau is an opalescent blue today that shifts when stirred. Harakeke, wiwi, oioi traverse her edges cooling what flourishes below with parawhenuamea. I shelter under a tī kōuka that gently sways, alive with birdsong. A heaviness still lingers, betraying and revealing the intangible that mediates the space between Papatūānuku and Ranginui.**

Another video was set at night with a full moon bright in the sky. You walk through the lush variety of native plants and as you walk past you hear the gentle rustle. The colour tone sits within the deep blues with the moonlight as the only source of light. There are only a few clouds in the sky. It feels cooler, you hear insects chiming. We follow a small well-walked track and move towards the wai. It's higher due to the tai kingi or the king tide. As you stand there the water moves. If you look carefully you can see the tuna coming out to play in the moonlight.

The differences between these environments were amplified purposefully using techniques similar to other earlier visualisations that played with the dynamic light, weather, fog, mist, sound, animation and the visual journey, all tools that assist in creating depth and focus within a digital environment. There were limitations as full immersion was not experienced, therefore not everything was centered around the visitor without obstruction. Instead they were provided with a framed view and a guided view, so not entirely used as I initially wanted. However, despite the viewer not being able to navigate their own movements and therefore not being fully immersed I do believe an embodied experience that connected the visitor to the wai and whenua emotionally was achieved.





## Endings

For this presentation I designed a visual feast that enticed and intrigued whilst providing all essential information accurately but compellingly just like telling a story, leaving people informed, engaged and hopeful for the future. Facilitating meaningful engagement is a precursor to action and through our presentation we worked to achieve that. We overcame the limitations of abstract data to help people see, hear and feel, experiencing the issues contributed with climate change in a multi sensory way. This provides opportunities for people to connect to their emotions and reestablish a deeply rooted experience through a Māori lens.

**“For Maori, this connection is both spiritual and physical, centered on earth and in the stars, laying upon the land and in its creation, throughout its waters and in the minds of those who have walked in them. And that is just the start” (Renata in Hill, 2021, p. 43).**



Figure 45 & Figure 46.  
Nighttime experience



### 5.3 Spatial Design as Facilitator

It's not just a science story, environmental story or a cultural story, it's about people, specifically empowering people to action. This project is incredibly rich in research, expertise and knowledge that has accumulated over many years with the help of many people. All of this has been aimed at restoring the mana and mauri of this rohe. It is not just about the science but also about the heart. Iwi and hapū understand that the natural world and all contained within it are taonga and tapu and they "are concerned with the resulting disassociation between land and culture" (Allan et al., 2017). The degradation of the wai and whenua is felt and mourned likewise the scientists who study with their depth of care also feel this. Care as the thing that emerges in that entangled contact zone of shared suffering (Haraway, 2003). Yes, we are part of the problem but more importantly we are the solution. Seeing action motivates society and policy makers, advancing the conversation and actioning the mahi. Spatial design as a facilitator is really about adding to this research, providing another way of seeing, listening and experiencing. I have put together a toolbox of innovative 3D spatial modelling technologies, to construct embodied narratives that communicate the importance of climate change and mātauranga Māori and translate past, present and future narratives

that inform how we care for ecologies and enhance the wellbeing of people and place. This provides a sense of agency through this mahi through shared experiences enabling effective participation. Rangimarkus Heke, who is a representative for te taiao matters and Horowhenua District Council and iwi representative said at the end of our final wānanga.

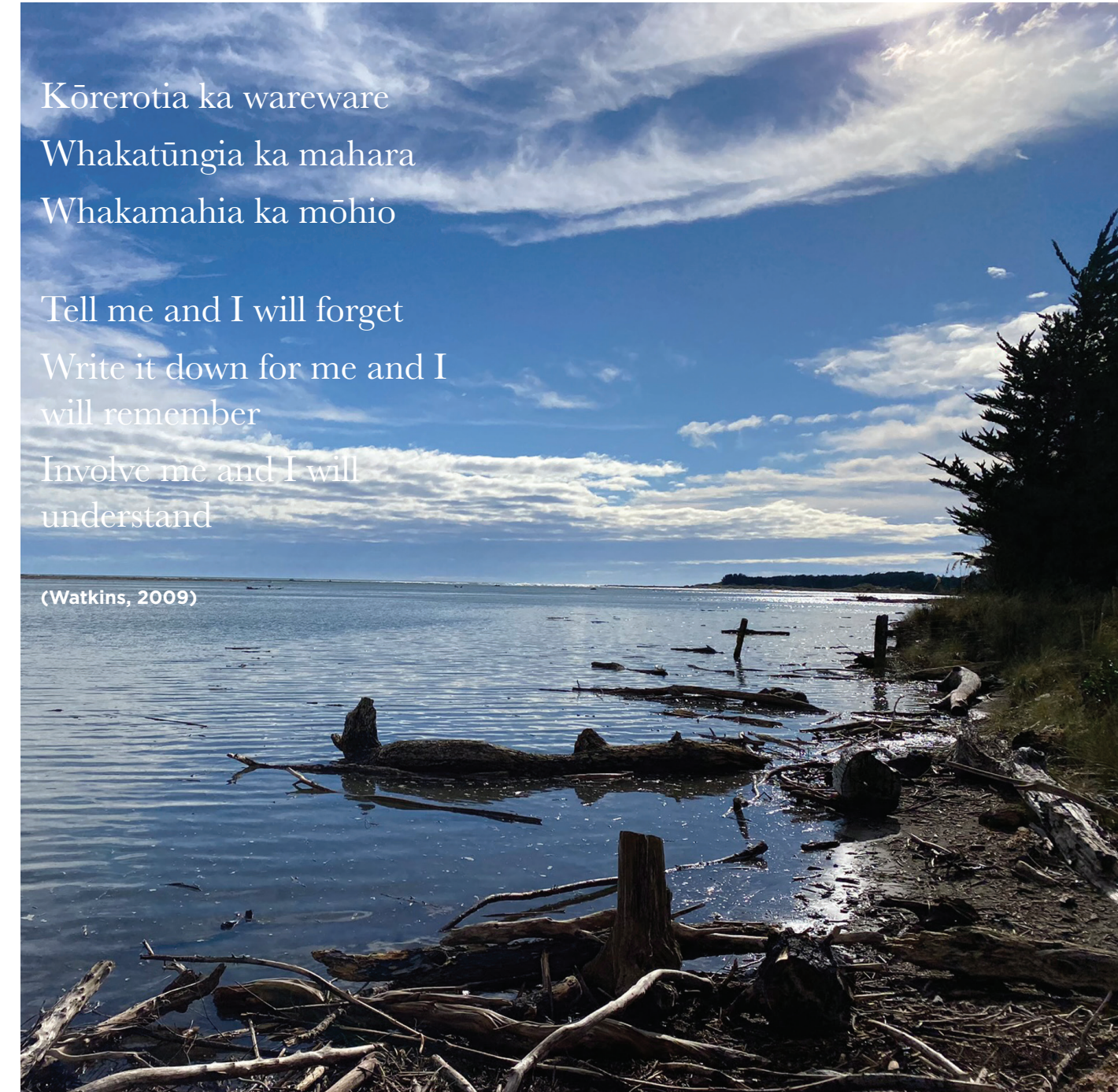
**"We implore you to reflect on what you have seen here and consider how you can contribute and help out the project to be realised into something physical. Our whānau has an open door policy when it comes to kōrero, don't be shy, reach out to the team and they will set you straight on an avenue to help" (R.Markus, personal communication, October 7, 2021).**

This presentation for the final wānanga has now gone through post production so that it can be distributed further, in the hopes of facilitating meaningful engagement, resulting in transformative change. Horizon Regional council is hosting a climate joint action committee where iwi representatives from the rohe are meeting with mayors, officials and regional council for wānanga and hīkoi. All my mahi has been packaged together in the form of a bound book, a large scale terrain model that reaches from the Tararua Ranges to the Tasman Sea, a storage device with all videos and visualisations as a koha to iwi and hapū of Kuku to tautoko the mahi anyway it and I can.

Figure 47  
After the flood | Kuku beach

Kōrerotia ka wareware  
Whakatūngia ka mahara  
Whakamahia ka mōhio  
Tell me and I will forget  
Write it down for me and I  
will remember  
Involve me and I will  
understand

(Watkins, 2009)





## chapter six

Climate change is a slow and deadly violence and a very real threat that lingers over us. In order to catalyse a paradigm shift where we can reconnect with nature and work to restore the balance of our fragile ecosystem, we are first required to look and face the world with sober eyes and determination.

Indigenous science and knowledge cannot be separated from western science. We need to synthesise and weave these knowledge systems together. Whakapapa provides a grounding perspective that is woven through the intricate layers that shape our understanding of our world and our place within it.

A mātauranga Māori approach is an emotionally connected knowledge acquired through lived and embodied experiences with nature as our teacher and guide. It is a relationship that is heightened and experienced more deeply because Māori understand that we evolved from the same elements that make up the natural world and that like us, nature “unfolds their lives in the same way as people” (Salmond in Hill, 2021, p. 25).

**“An inherent connection that can be both very simple and extremely complex. For Māori this connection is both spiritual and physical, centered on earth and in the stars, laying upon the land and in its creation, throughout the waters and in the minds of those that have walked in them” (Renata in Hill, 2021. p. 43).**

Western science brings with it a depth of care through its monitoring trends, quantifiable and factual data reading whenua and wai. It builds measured understandings and systems by creating empirically testable hypotheses that inform us on what is happening with our climate and what we can do to slow or reverse these impacts. The problems with western science that were identified were how to engage people and successfully communicate the importance held within the data. The double helix is a very real piece of our genetic puzzle, invisible and intangible, but when spatialised it becomes easier to comprehend.

### 6.1 Final Outcomes

Therein lies what I believe is the solution: Utilising Spatial design as a generative tool to construct embodied narratives that communicate the importance of climate change and mātauranga Māori.

Using narrative as a tool enabled me to embed meaning, provide opportunities for reflection, conversation and to share knowledge. Providing a platform for people to connect to their emotions on a deeper level and in turn reconnect to the ecological, social and cultural issues surrounding climate change now.

Visual 3D spatial modelling technologies were used including AR and VR applications, video, GiF, and simplified diagrams. Technical drawings, mapping, photography and embodied perspectives were also used to convey the journey by which the story was told. Other tools that were also utilised throughout this process included physical scale models, reflective journaling, drawing and watercolour painting as a form of responsive reflection, though not all have been elaborated on.

I have thrown every Spatial design toolbox strategy at this project, some more successful than others in order to translate this work as best I can into something meaningful.

To create immersive experiences through atmosphere, dynamic lighting, composition, colour and animation considering the ways in which we interact with, inhabit and experience space, whenua and wai physically, emotionally and spiritually. This aims to develop a deeper understanding of people and place.

The process of engagement throughout this mahi was an incredibly valuable experience, providing an opportunity to embrace a more fluid and diverse way of working. It is an approach where the underlying principles are based on a Māori world view (Smith, 1996).

As outlined earlier, I also believe a kaupapa methodology to be the most appropriate to employ for this project as it is guided by relationships to the environment, an embodied Māori way of knowing, led by iwi and hapū and grounded in mātauranga Māori. It responds to colonisation by ‘challenging norms and assumptions’ (Smith, 1999) that privilege western understandings and in turn becomes a method of decolonisation. I learned a lot about working with a diverse range of knowledge holders, and how so much can be understood by fully engaging in the process of hīkoi, wānanga and kōrero tuku iho.



## 6.2 Reflections

On self reflection, this project provided me with the opportunity to unearth and re-connect to an inherent knowledge that has always been within me, a part of me, but has been subdued by colonial blindness.

I understand in more profound ways my confused upbringing, questioning am I Māori? Is that okay and what does that look like? This has been a constant journey of rediscovery, learning and in some instances unlearning negative connotations that were associated with being Māori.

Overall, my own journey has brought about a deeper understanding of who I am, where I come from and what my cultural connections are but also what that means moving forward within my own whānau.

Undoubtedly there is still an overarching feeling of apprehension and imposter syndrome so more work ahead in unpacking some of this is required. However, I am incredibly thankful that even though this process has challenged me in every facet, from the process of engagements, understanding the science and how to articulate data to creating spatial environments that resonate emotionally and are rich culturally.

It is worthwhile to come out with a drive to understand and do more. Through discovery into my own whakapapa I have learned about whānau from Te Waipounamu I didn't know I had and have made plans to connect. Kōrero around our ancestral whenua in the wairarapa and protecting it have arisen.

My husband and I are both learning te reo, our boys are also gaining an interest particularly in the pūrākau we share at bedtime in lieu of our classic Hairy Maclary from Donaldson's Dairy.

Despite coming to the end of my masters project, it somehow feels like a new beginning.

## 6.3 Future Projects

In reality climate change is generated by the choices that people have made over the last 150 years. It is human influence that has warmed the climate at an unprecedented rate. It is something that will affect all of us.

This thesis has focused on the Kuku - Waikawa coastline in Horowhenua whereby I have outlined adaptation strategies, provided crucial information and worked within the kete of specialists to design wetland habitat ponds that look to enhance taonga species.

The reality is that climate change will affect some areas more than others. Samoa and other Pacific Islands in particular, are facing the effects of "rising temperatures, unpredictable rainfall, changing wind patterns, coastal erosion, tropical cyclones and sea level rise. Approximately 70% of Samoa's population and infrastructure is on low lying coastal land" (Latai-Niusulu, 2016), indicating the catastrophic potential loss of land, property and the dislocation of the island inhabitants, despite contributing low emissions.

Taking the knowledge that I have gained from this project and looking to the future, I will in some capacity be working with Nature-based Urban design for Wellbeing and Adaptation (NUWAO) a group that "aims to develop nature-based urban design solutions, that are rooted in Indigenous knowledge systems that support climate change adaptation and community wellbeing in Aotearoa including Te Awakairangi and Oceania including Apia, Samoa; Tarawa, Kiribati; and Port Vila, Vanuatu" (M.Pederzen-Zari, personal communication, August 13, 2021).

I am also interested in furthering this mahi through art and design practice as I really do believe that Spatial design can be used to weave multiple narratives, climate change science, ecologies and Mātauranga Māori knowledge, in order to produce meaningful kaupapa that enhances cultural understanding and wellbeing.

Figure 47.  
whānau | Kuku beach





## Glossary

Aotearoa: Original Māori name for New Zealand	Kaumātua: Elders	particularly in the hospitality shown to manuhiri	Oioi: [Apodasmia similis]	Tangata whenua: Local people, hosts, indigenous people	Toheroa: Mollusca [Paphies ventricosa]
Aroha: Love, understanding, compassion	Kaupapa: Policy, plan, scheme, proposal, agenda, subject	Manu: Birds	Pākehā: A white New Zealander	Tāne Mahuta: Atua (God) of the forests and birds	Tohu: Sign, mark, symbol, indicators of an event
Atua: Guardians of natural realms, gods	Kawa: Protocols and customs	Manuhiri: Visitor, Guest	Pānui: Newsletter, an announcement, report, statement	Taonga: Treasure – applied to anything considered to be of value including socially or culturally valuable objects, resources, phenomenon, ideas and techniques	Tohunga: Important holder of knowledge, Priest
Awa: River, stream, waterways, fresh water bodies	Kete: Handwoven basket	Manuka: [Leptospermum scoparium]	Papatūānuku: Earth, Earth mother and wife of Ranginui – all living things originate from them	Taonga species: Native birds, plants, and animals of cultural significance	Totara: [Podocarpus totara]
Hapū : Kinship group, clan, tribe, subtribe, pregnant	Koha: Gift, contribution	Māori: Indigenous New Zealander	Parawhenuamea: Atua of freshwater	Taniwha: Powerful creature, leader, chief	Tuna: Eel
Harakeke: Flax [Phormium tenax]	Kōkopu: the name for three species of fish of the genus Galaxias	Marae: Courtyard - the open area in front of the wharenui, where formal greetings and discussions take place. Often also used to include the complex of buildings around them.	Paru: Dirty	Tāwhirimātea: Atua (God) of the winds, clouds, rain, hail, snow and storms	Tūpuna: Ancestors
Harirū: Process of powhiri, shaking of hands	Kōrero: Conversation, discussion	Maramataka: Lunar calendar, Planting and fishing calendar	Pepeha: Recitations linking people to place	Te Ika-a-Māui: North Island of New Zealand	Wai: Water
Hīkoi: To step, stride, march, walk	Kōrero tuku iho: Oral traditions	Mātauranga Māori: Traditional and contemporary Māori knowledge, knowledge systems and knowledge bases.	Pou: Post, pole, pillar	Te Reo: Māori language, voice	Waiata: Song
Hui: Gathering, meeting, assembly	Koromiko: Hebe	Maunga: Mountain	Pouwhenua: Boundary marker, land marker post, land symbol of support	Te Taiao: Earth, natural world, environment	Wairua: Spirit, The spiritual dimension to life
Īnanga: Whitebait	Kōtuku Ngutu-Papa: Royal Spoonbill [Platalea leucorodia regia]	Mauri: Life force, source of emotions, an energy, internal element, a sustaining life force or spirit, a soul	Pōwhiri: Welcoming protocol for visitors	Te Wai Pounamu: South Island, translates as the greenstone waters	Wānanga: Forum, conference, workshop.
Iwi: Extended kinship group, tribe, nation, people	Kūia: Grandmother, female elder	Mamaku: black tree fern [Cyathea medullaris]	Puku: Stomach	Te Whanga nui ā tara: Wellington	Whaikōrero: Formal speech
Kai: Eat, food, dine	Kūmara: Sweet Potato	Moana: Sea, ocean, large lake	Pūrākau: Creation Stories	Tikanga: The customary system of values and practices	Whānau: Extended family, family group, a familiar term of address to a number of people.
Kāinga: Unfortified settlement for day to day living	Mahi: Work, job, employment, occupation, activity, exercise, operation, function	Mokopuna: Descendants, grandchild	Pukio: [Carex virgate]	Ti kouka: Cabbage Tree [Cordyline australis]	Whare: House
Kaitiaki: Trustee, minder, guard, custodian, guardian, keeper	Mahinga kai: Customary gathering and use of naturally occurring and cultivated foods	Ngā mihi: Acknowledgements	Ranginui: Atua (God) of the sky and husband of Papatūānuku (Earth mother) Sky father	Tirotiro: Observations	Wharenui: Ancestral meeting house
Kaitiakitanga: Guardianship	Makomako: Wineberry [Aristotelia serrata]	Ngāti: Prefix for a tribal group	Raupo: Bulrush [Typha orientalis]	Toetoe: [Austroderia fulvida]	Whenua: Placenta, land, connection to land and water, the umbilical cord connecting people to place
Karakia: Incantation, chant, Pray	Mana: Authority, spiritual authority, protective power and prestige		Reo: Language		
Karamu: [Coprosma robusta]	Manaakitanga: Sustenance, care, and support,		Rohe: District, area, territory, vicinity, region		
			Tapu: Sacred, restricted		



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### EMBODIED LEARNING

Wānanga on the 16th of October 2020, at Tukorehe Marae in Kuku.

Wānanga on the 19th and 20th of November 2020, at Tukorehe Marae in Kuku.

Wānanga on the 31st of January 2021, Zelandia, world wetlands day.

Wānanga on the 1st and 2nd of February 2021, Zelandia, Tuna Translocation, Otari

Wānanga on the 15th and 16th of July 2021, at Island Bay address in Wellington.

Wānanga on the 25th of July 2021, annual planting day, East Harbour Regional Park, Wellington.

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