Conditional Grounds:
Architecture for the Whangamarino Wetland

Master Thesis Explanatory Document
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Abstract

The connection architecture can make with the ground is rarely given the attention it deserves. It is the first junction that architecture is required to make. The research project selected a diverse and challenging site in order to bring this fundamental connection back into focus.

The Whangamarino wetland has currently no means of public access. In the wetland, the ground, the water, and the vegetation are inextricably linked. These three factors combine in different degrees and create a variety of unique conditions for architecture to connect to.

It was found that the connection to the ground could be enriched through stereotomic and tectonic expression coupled with the use of datum to emphasise variations in water and vegetation levels. The resulting architectural interventions demonstrate that by engaging with the diverse ground conditions, architecture’s connection to the ground can enhance the visitor’s experience of the Whangamarino wetland.
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1.0 Introduction
1.1 | Research Question

How can architecture’s connection to the ground enrich our experience and engagement with a diverse and challenging site?
1.2 | Aim and Objectives

The connection that architecture makes with the ground is a rich, but often overlooked aspect. The following research project aims to explore this fundamental junction of architecture. The way we attach architecture to the ground expresses our understanding and attitude towards the natural quality of the site.

The programmatic aim of this project is to provide the public with access to the internationally significant and currently inaccessible Whangamarino wetland. The connection to the ground will play a fundamental part in providing this access. Through an in-depth site analysis the physical and intrinsic qualities of the site will be studied in order to inform the design. The Whangamarino has a diverse range of conditions that make it a perfect test site for an exploration into the architectural possibilities of connecting to the ground. The connection to the ground will not be merely one of necessity, but rather a connection that enriches the visitor’s experience and engagement with the site.

The architecture will be the mediator between the visitor and the wetland environment. The variable ground condition in the wetland will require an architectural intervention to exist throughout. The intervention will create a new architectural ground in the wetland.

1.3 | Scope and Limitations

The scope of this project is to design an access facility for the Whangamarino wetland. This facility may include a visitor centre, walkways, bridges and viewing structures. The emphasis of the project will be to explore the way in which these facilities will be connected to the ground.

This project will be limited by the available information about the Whangamarino wetland. The hydrological processes operating in the wetland are complex and dynamic and are still not fully understood. Water level readings from specific areas in the wetland have been generalised in order to allow the information to be used in the design process. The topographical information available for the site is also limited. Current contour information is only available at 20m intervals. The 20m contours fail to describe the subtle variance in ground elevation that occurs throughout the wetland. The contour information will instead be generated from my own observations and from general trends in the 20m contour map.
Figure 1.4.1  |  Kayaking down the Whangamarino River
1.4 | Methodology

The methodology for this project encompasses research through site analysis, literature, and design.

**Research through Site Analysis**
Research through site analysis formed an important part of this research project. The architectural response relies on an in-depth understanding of the specific nature of the ground condition found throughout the Whangamarino wetland. It was therefore crucial that the many characteristics of the site were collated and analysed in order to inform and guide the architectural response. Site visits and consultation with the Department of Conservation Ranger were also crucial to gain a first-hand experience of the many different un-documented qualities of the site.

**Research through Literature**
Research through literature was carried out in two separate, but intertwining parts of theoretical literature and precedent analysis. Literature was used to identify important theoretical positions that are relevant to architecture’s connection to the ground. This project is focused on exploring the way in which architecture can exist in a wetland and it was useful to focus on existing architectural strategies at similar sites.

**Research through Design**
The main method used in this project was research through design. The previous site investigation, precedent analysis, and literature survey all informed and guided the project through the design phase. The design process made use of physical models, concept drawings, and computer models. Physical modelling was an important part of the design process as it allowed for a three-dimensional exploration of details and their architectural impact.
Figure 2.1.1 | Whangamarino Wetland, Photographed from Island Block Road
Understanding the site
2.1 | Location of the Whangamarino Wetland

The Whangamarino wetland is located in the Lower Waikato and covers an area of approximately 5923 hectares. It is the North Island’s second largest wetland and it is one of only six wetlands in New Zealand to be recognised as internationally important. It is approximately one hour’s drive from Auckland and lies to the east of State highway 1. The wetland is accessed from Island Block road which travels through the centre of the wetland and links up with Falls road which lies along the eastern edge. The small towns of Meremere and Te Kauwhata border the wetland to the North West and south respectively.

The wetland drains out into the Waikato River which lies to the west of the wetland. Lake Waikare lies to the south of and drains into the wetland. The wetland has three main rivers that run through it: The Whangamarino River, Pungarehu Stream and the Maramarua River. The wetland is surrounded by agricultural land. The fragmented nature of the wetland is a direct result of the higher elevated ground being drained throughout history and converted into agriculture land. The remainder of the wetland has since been protected and drainage has ceased.

The Whangamarino wetland was chosen as it provides a diverse and challenging ground condition to explore architecturally. The variable ground condition will require a demanding architectural response. There is currently no access for the general public aside from two boat ramps. The ground condition varies from swamp to bog.

Figure 2.1.4 | The Whangamarino Wetland
Wetlands in New Zealand have had a turbulent history. Prior to European settlement wetlands covered twenty percent of the total land area in New Zealand whereas today this number has dropped considerably to less than two percent.¹ The Waikato region alone has lost 70 percent of its wetland since European settlement.² This staggering loss of natural heritage can be attributed to a lack of understanding of the importance of these unique environments.

In his article ‘Invading the Waikato: A Postcolonial Re-view’, author Simon Dench discusses various historical images and their subliminal depiction of the attitudes of European colonists towards the Waikato.³ For Dench, images like the ‘Scene near Whangamarino Bridge’ [Figure 2.1.1] operate as ‘value-laden constructions and powerful transmitters of ideology’.⁴ The gun slung over the shoulder, the wheel barrow and the fence are all powerful symbols of the front line of European expansion where nature and the natives needed to be tamed.

Wetlands were viewed as boundaries to progress and as such were drained to make room for agricultural land. The destruction and drainage of wetlands had unforeseen consequences resulting in shrinking water resources, a lack of flood storage, and most importantly the extinction of native plants, animals, fish and birdlife. The Whangamarino was and still is extremely important to Maori as a food source, for building and clothing materials and as a means of transport. There are at least nine former pa sites located along the

4. Ibid., 35.
eastern edge of the wetland.
In 1961 continual flooding of farmland led to the lower Waikato–Waipa flood protection scheme which saw the installation of stop banks, pumps, weirs and flood gates. This had an immense impact on the Whangamarino wetland causing its water level to drop by 1.5m which in turn saw the wetland shrink by almost a third of its previous size.  
An important turnaround for wetlands occurred in 1971, when 18 nations met in the town of Ramsar in Iran to discuss the degradation of the world’s wetlands. This convention resulted in an intergovernmental treaty for the protection of internationally important wetlands. This treaty is commonly referred to as the Ramsar Convention. New Zealand became involved with the Ramsar Convention in 1976 and currently has 6 Ramsar registered wetlands.
The Whangamarino wetland was added to the Ramsar List in 1989 and in 1993 it became a Government Purpose Reserve managed by the Department of Conservation with parts also managed by Fish and Game. In 1994, the Whangamarino wetland received a $1.4 million rehabilitation programme which importantly saw the installation of a weir to raise water levels. This had a huge benefit to the Whangamarino wetland and saw an immediate increase in the number of water birds seen in the wetland.
Wetlands have been described as ‘nature’s kidneys’. The filtering process is as follows:
"As water moves into a wetland, the flow rate decreases, allowing particles to settle out. Plant surfaces provide for filtration and absorption of solids, and add oxygen to the water. Growing plants remove nutrients. This cleansing role of wetlands protects downstream environments."  
Wetlands regulate the ground water level by absorbing and storing water during high rainfall and releasing the water gradually afterwards.
Our attitude towards these environments has changed drastically

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6. Ibid., 61.
over the relatively brief history of this country. A crucial barrier to the appreciation and protection of wetlands are the problems around access. The difficulties involved with access are a result of significant water level variation and the unreliable nature of the ground condition. The Whangamarino wetland is currently only accessible via boat and is mainly accessed by duck hunters and fisherman.

2.3 | The Importance of the Whangamarino Wetland

The Whangamarino wetland is ‘an interconnected system of peat bogs, peat swamps, ponds, lakes, streams and rivers’. The Whangamarino wetland is home to a variety of nationally important flora and fauna. The Whangamarino wetland is an important habitat for the native long fin eel, the endangered black mudfish, and the Inanga (whitebait). It is home to 25% of the endangered Australasian Bittern population in New Zealand. The wetland is also home to a large waterfowl population including the introduced Mallard and native grey duck (>25,000), the New Zealand Shoveler (<3,000 in August), Grey teal (<2,000), and the Black Swan. The wetland contains a number of threatened plants including the water milfoil, the rare swamp helmet orchid and the club moss. Duck hunting is a popular activity in the Whangamarino with maimais (duck hides) scattered around the waterways of the wetland. Duck hunting season starts in May and continues to the end of June. Additionally recreational and commercial fishing occurs around the main waterways.

10. Ibid., 4.

**Total size of the Whangamarino Wetland:** 5923 hectares

**Average rainfall:** 1,200mm (ranging from 1,100 to 1,500)

**Average temperature:** 9°C in winter to 19°C in summer

**Prevailing wind:** Westerly, Fog is common
Figure 2.4.1 | The Whangamarino wetland catchment area

Figure 2.4.2 | The Whangamarino wetland river and lake system
2.4 | Ground, Water and Vegetation

In wetlands the ground, vegetation and water are inextricably linked. Architecture’s connection to the ground will need to respond to all three of these factors. The following pages will expand on this interconnected relationship.

2.4.1 | Water

Water plays a crucial part in the ecosystem of wetlands. The hydrological processes operating in the Whangamarino wetland are complex and are still the subject of on-going research. The Whangamarino wetland is a freshwater wetland meaning that it receives water from precipitation, tributary streams and from its catchment area. The water level in the wetland is directly linked to the seasonal differences in rainfall. Although the Whangamarino wetland is only 5923 hectares, it has a catchment area of 48,900 hectares [Figure 2.4.1]. The large catchment area causes the water level in some parts of the wetland to rise by 2.5m during periods of high rainfall. Water levels in the Whangamarino wetland were studied by James Blyth in his 2011 Master’s thesis. He concluded that sites up to 500 m from the Whangamarino river were likely be inundated by floods every year while sites up to 1.4km from the river were likely to be inundated every 3.3 years.

There are three primary waterways that run through the Whangamarino wetland [Figure 2.4.2]. The Whangamarino River flows from the eastern edge of the wetland and cuts between the central and southern peat bogs. The Pungarehu stream flows from Lake Waikare and joins into the Whangamarino River. To the north, the Maramarua river flows from the northeast corner of the wetland before merging with the Whangamarino river and eventually flowing out in to the Waikato River.

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### 2.4.2 | Slow Change

To illustrate the slow water level change in the Whangamarino wetland, the water level record for 2010\textsuperscript{13} was plotted against the 2010 Auckland harbour tides [Figure 2.4.3].\textsuperscript{14} The graph contrasts the regular rhythm of the Auckland tides with the wetland water level, which is linked to seasonal rainfall variations. Forecasting the exact water level at a given point or time of year within the wetland is impossible. The water level can however be loosely linked to the seasons of the year. In winter and spring the higher rainfall results in high water levels, while in summer and early autumn water levels decrease due to lower rainfall. The water level information available for the wetland is patchy and what does exist has been simplified for the purpose of the project.

An important area of exploration will be how the variable water level can be architecturally communicated. If a person was to visit during the summer months, they may fail to grasp the significant changes in water level that occur.

\textsuperscript{13} James M. Blyth, “Ecohydrological characterisation of Whangamarino Wetland” (Masters diss., University of Waikato, 2011). 127.

Whangamarino Wetland Water Level
Figure 2.4.4 | The Whangamarino wetland photographed in Autumn
2.4.3 | Physical Ground

The substrate of the Whangamarino wetland is primarily peat. Peat is partially decomposed plant remains that form the substrate of certain types of wetlands, which in turn are described as peat bogs and/or peat swamps. The wet conditions found in wetlands inhibit the flow of oxygen which in turn reduces the rate of decomposition. Peat is comprised of 40-90 percent organic material. This high amount of organic material causes peat to act like a sponge absorbing water during flood events and slowly releasing it in dryer periods. The variation in the structure and texture of peat is a result of the overlying wetland vegetation that degraded to form the peat. The connection to the ground will have to deal with the poor structural capacity of peat. Several methods of building on peat will be discussed in the following sections.

In the Whangamarino the areas adjacent to the rivers and stream margins contain alluvial sediment mixed with organic material. The nutrient rich sediment is brought in and deposited by the annual floods.

The Whangamarino wetland can be divided into roughly three zones: a central Restiad bog zone (light green), an encroaching Manuka swampland zone (dark green) and a mineralised swampland that surrounds the rivers (light blue).
The centre of the wetland is referred to as a restiad bog and is the most ecological important part of the wetland. The restiad bog areas are slightly higher in elevation than the rest of the wetland due to the build-up of peat (peat dome effect). The bog remains above the water table and receives no surface water from the river systems. Its only source of water is from precipitation. The restiad bog remains waterlogged due to its peat substrate. The sole input of water from precipitation results in low nutrient levels and high acidity which cause slow growth rates in vegetation.

There are only a few native bog plants species that can survive in the low nutrient highly acidic conditions found in the central bog region. The main groups are Empodisma minus (a type of wire rush), Gleichenia dicarpa (Swamp Umbrella Fern) and Baumea spp (twig-rush). This zone is characterised by low lying sedges and wire rush which allow for vast panoramic views of the central bog. The slow growth rates of the vegetation will mean that any disturbance will require a considerable amount of time to repair. The sensitivity of the environment will be an important factor in the design of any architectural intervention.

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2.4.4 | Manuka Swampland

The next zone is the manuka swampland. This zone directly surrounds the restiad bog. The dominant water inputs are from surface water and rainwater. The increase in nutrients and surface water allows a dominant canopy of manuka to emerge.\textsuperscript{16} Tall manuka with a maximum height of 6 metres surrounds the restiad bog. The manuka trees in this belt form a predominantly open canopy. The understory bog species gradually decline as nutrient levels increase and are eventually replaced by a dominant swamp umbrella fern.

As one moves further out the tall manuka is replaced by a shorter and denser manuka. This manuka is 3 to 4 metres in height and its dense canopy restricts the development of an understory. Little light penetrates through the canopy and it is one of the only places in the wetland where bare ground is exposed.

Flood water will reach the tall manuka belt roughly every two years with an average depth of around 0.3m.\textsuperscript{17} The shorter manuka belt also receives flood water at least every two years but to an estimated depth of 0.7m.\textsuperscript{18} The connection to the ground in this part of the wetland will need to acknowledge the variable water level and the character of the vegetation and substrate.

\textsuperscript{16} Blyth, “Ecohydrological characterisation of Whangamarino Wetland.”\textsuperscript{106}
\textsuperscript{17} Ibid., 147.
\textsuperscript{18} Ibid., 147.
2.4.5 | Mineralised Marshland

The manuka zone is eventually replaced by a small belt of 2.0m tall dense swamp coprosma. This area receives ground water, surface water and precipitation. The swamp coprosma gradually declines into open seasonal advents and grasses. Also present in this open swampland is the occasional cabbage tree and invasive grey willow. This open swampland is relatively close to the rivers and contains a mixture of ponds, streams and banks. This swampland has a dynamic water table being covered by a minimum of 0.5 m flood water during the winter months of the year.19 Approximately every two years the flood water level can reach up to 2.0 m.20 The rivers cut through swampland and are present throughout the year. Along the river banks higher nutrient concentrations and variable water levels cause invasive willow and weeds to dominate. The connection to the ground in this part of the wetland will need to acknowledge the significant variance in water level.

20. Ibid., 147.
2.5 | Site Visits

The first site visit was undertaken in the May 2012 at the beginning of the duck hunting season. This visit involved kayaking down the Whangamarino River. The river was incredibly still and gently meandered its way through the wetland. Willow trees were dominant on the northern side of the river with their leafless branches being reflected in stunning detail on still surface of the river. The river appeared to have no solid ground below its surface. The murky waters completely obscured the bottom of the river.

The second site visit involved an analysis of a few maimais (bird hides). The higher maimais provided a view of the wider surroundings which helped to orientate myself after the trip down the winding river. The maimais were built in a very make shift fashion by the duck hunters.

A third visit during May involved walking around the edge of the wetland. The seasonal adventives and grasses painted the landscape red.

A visit in the middle of winter to this same spot revealed a completely different wetland. Now the seasonal adventives and grasses were completely submerged in a huge body of water. The maimai structures appeared as islands in a vast lake. The boat ramp car park was now under several metres of water.

A further site visit in January 2013 involved a kayak and walk through the wetland. The ground varied from dry patches to water logged patches. On several occasions the water level became extremely low and I was effectively paddling through a muddy swamp. I left the kayak and continued on foot walking from the seasonal grassland into the swamp coprosma. The build-up of vegetation was gradual, but the denser the vegetation got the more difficult walking became and I decided to return to the kayak with wet shoes and scratched legs.

I managed to make it further into the wetland during another site visit in February. The ground was free of surface water but was still damp despite a very dry summer. The swamp coprosma zone was extremely difficult to get through due to its density. There was a sudden transition into the short manuka zone where it became less dense and easier to walk. The short manuka was about 4m in height and its dense canopy cut out most of the light. The dark peat soil was covered only by dead manuka. The transition between the short manuka zone and the tall manuka zone was also abrupt. The tall manuka was about 6 metres in height with a relatively broken canopy. A strong undergrowth of swamp umbrella fern was roughly half a metre in height and completely obscured the ground.

The site visits helped to gain an understanding of the factors that will influence architecture’s connection to the ground in a wetland environment. The main idea identified was that water and vegetation will mediate the understanding of the ground.
Figure 2.5.2 | A maimai (duck hide) accessed by a narrow boardwalk
Programme Development
3.1 | Selection of a specific site within the wetland

The selection of a specific site within the Whangamarino wetland was influenced by the research into the site and from a discussion with the DOC Whangamarino wetland ranger Kevin Hutchinson. The two factors that influenced the selection of the specific site to enter the wetland were easy access to a public road and the proximity to a variety of wetland conditions.

There are two main roads that provide vehicular access to the Whangamarino wetland. Island Block Road crosses through the slightly elevated farmland situated in the middle of the wetland and Falls Road travels along the eastern boundary of the wetland. The wetland only converges at one point along Island Block Road and offers only two types of vegetation. At the southern end of Falls Road the ground rises in height and offers a stunning view into the swamp land. A range of vegetation types and wetland features are in a relatively close proximity making it an ideal position for the entry point into the wetland.

The Department of Conservation has been trying to develop a visitor centre for the Whangamarino wetland for some time but has run into difficulties on several occasions. A previous scheme by DOC, which was situated adjacent to the main bend in Falls Road, ran into cultural objections due to its proximity to an historic Maori Pa site. This ultimately stopped the scheme from going ahead. A decision was made to avoid this particular part of the site [Figure 3.1.4]. The final selected site is situated on a small but adequately sized part of land that protrudes into the wetland. It was chosen as it offers panoramic views of the wetland and is also adjacent to Falls Road and the existing boat ramp facilities.

Figure 3.1.4 | Map of selected site
3.2 | Programme

The architectural programme is to provide public access to the largely inaccessible Whangamarino wetland. The waterlogged ground condition in the wetland will require some degree of built path to allow public access. The Arawai Kākāriki Wetland Restoration Programme 2007 – 2010 report which includes the Whangamarino wetland highlighted the need to “improve facilities and opportunities for the public to visit the Whangamarino”. The only facilities currently are two boat ramps with a small car park.

The journey through the wetland was originally conceived as a looped circuit. A looped walkway would cover a distance of over 3km. This large distance made it difficult to contemplate the overall design in any meaningful detail. It was decided that a single walkway that leads through the wetland from the outer edge to the centre would be more achievable and provide the visitor with a comprehensive appreciation of the different wetland environments. The scale of the single walkway was still significant and it was decided to focus on specific points of interest along the walkway.

At these points of interest an architectural intervention was made. Each intervention was influenced by the variable water level, the ground condition, and the surrounding vegetation.

The interventions in the wetland provide different ways of experiencing the wetland and consist of boardwalks, bridges, viewing shelter and observation towers. The size of these interventions meant that it was necessary to develop their construction in a fair amount of detail.

The entry intervention is a visitor centre. The visitor centre is comprised of a small Department of Conservation office and a public area. The DOC area will provide an onsite base for the ongoing research and monitoring occurring in the Whangamarino wetland. The DOC area contains a small office space, toilet facilities, and indoor and outdoor storage areas for equipment. The public area contains an educational display, a briefing space for organised events, a cafe, and toilet facilities.

The interventions develop a range of connection to the ground based on their specific location and function within the wetland.

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Figure 3.2.1 | Map of selected site showing rough location of interventions
Maori Pa

The hills on the eastern side of the Whangamarino are home to 9 Maori pa. The proximity to the wetland was a huge benefit to the maori tribes as it provided a source of food, building material, and a means of transport. Near the edge of the wetland, one can see the remains of some midden pits used by Maori.

Prominent Hill

There are several prominent hills that border around the Whangamarino. They have a strong presence in the largely flat wetland.

The Sky

The Whangamarino’s vast skies emphasise the flat landscape.

Falls Road

One of two roads that provide access to the Whangamarino.

Kahikatea Tree

This pencil shaped native tree once featured prominently around the Waikato. Organisations such as Project Kahikatea are encouraging the replanting of Kahikatea around the Waikato. Only a few small isolated groves of Kahikatea remain in the Whangamarino.
Grey Willow zone
Grey Willow have a negative impact on the Whangamarino wetland. They grow rapidly and produce copious amounts of wind-blown seeds. This makes it difficult for the Department of Conservation to eradicate. Current research is exploring the effectiveness of different spraying methods.

Pungarehu Stream
The Pungarehu stream connects the Whangamarino wetland and Lake Waikare. A large amount of sediment enters the Whangamarino via this stream.

Seasonal Grassland

Maimai (duck hide)
4.0

Current Knowledge
4.1 | Architecture’s connection to the ground in a wetland environment

The existing ground connection techniques for wetland environments are helical piles, friction piles and if necessary pontoons. A helical pile utilises helices placed along a steel shaft which is then physically screwed into the ground. The number of helices and the length of the pile is determined by the soil quality and the structural load to be supported. Friction piles work in a similar fashion relying on the surface of the pile developing friction against the surrounding soil. The deeper the pile the more friction developed. Helical piles are easier to install than friction piles and also create less ground disturbance.

Pontoons are also used in certain situations in wetlands. They comprise of a deck, frame and float. The float can be anything from plastic drums to foam filled tire. Anchorage must be provided to prevent the pontoon from drifting around. This can be achieved by either guiding posts or cables. The design must also incorporate methods to protect the floats from grounding. This can be achieved by placing supports underneath the pontoon.

An additional option of connecting to the ground is to simply rest on its surface. This technique is incorporated in areas where water is minimal and does not fluctuate.

The technical challenges of building in a wetland have commonly been addressed by these types of solution. These current methods of connecting to the ground however are often uniformly applied and subsequently have little influence on the experience and understanding of the wetland. In order for architecture’s connection to the ground to enrich the experience and increase the understanding of a wetland environment the expressive potential of structure, construction, and detailing will need to be explored. This leads into an investigation into tectonics.
4.2 | Tectonics

Tectonics is a heavily debated topic in architecture and as such it is a difficult term to define.

A clear definition of tectonics is outlined by Eduard Sekler in his essay *Structure, Construction, Tectonics*. He sets out to define these three terms. The term structure refers to the underlying abstract concept such as a post and lintel system. The term construction refers to the physical realisation of the structural concept which includes choices in materials and how they are connected. The physical realisation (construction) of the structural concept will result in an expression that cannot be explained purely in terms of construction or structure. This expression is what Sekler calls the tectonic and he identifies it as the most architectural of the three terms. He concludes that:

“Through tectonics the architect may make visible, in a strong statement that intensified kind of experience of reality which is the artist’s domain – in our case the experience of forces related to forms in a building. Thus structure, the intangible concept is realised through construction and given visual expression through tectonics.”

Sekler acknowledges that his three concepts of structure, construction, and tectonics can be combined in different ways. Each concept does not need to have equal importance in the final building. An example he uses is the Parthenon. Sekler explains that its construction out of stone is ill-suited to its post-and-lintel structure and yet despite this it clearly has a powerful tectonic statement.

To enrich the experience and increase the understanding of a wetland environment the connection to the ground can therefore through tectonics make visible the difficulties in support and stability.

A different way of looking at tectonics is outlined by Kenneth Frampton in his book *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Frampton picks up on ideas formulated in the 19th century by the German architectural theorist Gottfried Semper. Semper’s publication *Die vier Elemente Baukunst* (*Four Elements of Architecture*) (1851) divided primordial dwellings into four elements of the earthwork, the hearth, the framework/roof, and the lightweight enclosing membrane. Semper’s four elements were a hypothetical interpretation of primordial dwellings drawn from several vernacular buildings found throughout the world.

Frampton states, that Semper divides “built form into two separate material procedures: into the tectonics of the frame, in which members of varying lengths are conjoined to encompass a spatial field and the stereotomics of the weight, pressure and resistance in the forms we see.”

Sekler acknowledges that his three concepts of structure, construction, and tectonics can be combined in different ways. Each concept does not need to have equal importance in the final building. An example he uses is the Parthenon. Sekler explains that its construction out of stone is ill-suited to its post-and-lintel structure and yet despite this it clearly has a powerful tectonic statement.

To enrich the experience and increase the understanding of a wetland environment the connection to the ground can therefore through tectonics make visible the difficulties in support and stability.

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23. Ibid., 93
compressive mass that, while it may embody space, is constructed through the piling up of identical units.”25

Frampton builds on Semper’s tectonic/stereotomic distinction and notes the “affinity of the frame for the immateriality of sky and the propensity of mass form not only to gravitate towards the earth but also to dissolve in its substance”.26 He further articulates this difference between light and heavy by acknowledging the different material associations, with the tectonic frame favouring tensile materials such as wood and bamboo and the stereotomic favouring compressive materials of brick, rammed earth, and concrete.

The use of stereotomic construction to connect to the ground in a wetland would not only be technically difficult, but also insensitive to the wetland environment. There is however the one exception of the entry point into the wetland where stereotomic compressive mass may provide a strong contrast to the lighter tectonic frame construction occurring further into the wetland. This harsh contrast and transition could be used to enhance the experience and understanding of the precarious ground condition in the wetland.

4.3 | Precedents

A precedent situated close to the Whangamarino wetland is the Maori Entrenchments at Rangiriri. The entrenchments were built by Maori during the Waikato wars of 1863 – 1864 and consisted of a high parapet and a double ditch that stretched across a narrow strip of land between the Waikato River and Lake Waikare. The sections show an interesting example of stereotomic earthwork that demonstrates an intertwined connection with the ground. An analysis of these section shows that the front edge of the parapet is sloped with habitation occurring on top while the sides of the ditches in the middle of the fort are kept straight. The fortifications are being considered purely on formal grounds. Stereotomic earthwork positioned on the edge of the wetland could be used to emphasise the last point of solid ground before entering the wetland.

A more articulated stereotomic precedent is the Maryhill Overlook project by Allied Works. Their intervention explores how an object can increase a visitor’s connection to the surrounding landscape.

“The Overlook serves to amplify the natural and experiential forces at work on the site. It is a demarcation that allows occupation and provides a measure of scale, distance, and time. Through a single act of making, the inherent architecture of this landscape is revealed.” 27

The project consists of a single ribbon of concrete that is folded to create open and closed spaces. The visitor experiences the project and the surrounding landscape via a path that weaves back and forth.


through the folding ribbon of concrete. The ribbon almost appears to be stitched into the landscape. At its start it emerges as a single horizontal slab that soon folds down to meet up with the falling ground plane. On one level, the intervention acts as an abstract representation of the surrounding landscape, which is characterized by a strong horizontal landscape cut by deep valleys. On another level the intervention provides a sense of scale, and draws attention to various parts of the landscape and the environment.

The many cuts and folds of the overlook act like an unmarked sundial, casting shadows that change throughout the day. The folds and cuts also provide the visitor with a sense of scale of both the immediate site and also the surrounding landscape. The scale of slope in the site is revealed by the intervention maintaining a continuous height. The folds and cuts provide the visitor with seats which introduces a human scale into the work.

The overlook’s main axis points out across the Columbia valley to a flat stone outcropping. This helps to anchor the project by terminating its axis with a feature in the landscape.

The Maryhill Overlook provides a number of interesting ideas that could be incorporated into design of the interventions in the wetland. The folding and cutting of the concrete ribbon may be a potential strategy for the stereotomic to transition into the tectonic. The idea of using the structure to provide a sense of scale could be used in the wetland to help the visitor gauge the variable height of the water level. The directing of views to the surrounding landscape by the overlook could be similarly used to highlight prominent features in the wetland landscape.
The Whangamarino wetland is largely free of any sort of built object with the exception of a scattering of duck hides (maimais). These maimais portray a ‘do it yourself’ approach by locals in order to create refuges in the wetland for recreational hunting. The variance between each maimai can be quite significant. They do however usually share a common feature of wrapping bush material (usually locally sourced manuka branches) around the structure in an attempt to conceal themselves from their cautious feathered rivals. Building material generally consists of corrugated steel sheet, plywood, and an array of different sized timber members. A certain ‘birds nest’ principle of using whatever discarded material one could find at the time appears prevalent. The maimais demonstrate a practical approach to function. The bending of the corrugated roof down to overlap the walls slightly whilst crude it represents a clever technique to prevent wind and rain from passing through. A few maimais even included a floating access platform to address the variable water level.

The maimais are an established part of the landscape and do not appear intrusive or disrespectful. This is perhaps due to the delicate balance these structures seem to have with the site. The maimais bear the scars of the environment, are covered in mud, water stained and sinking in some places. Materials are heavily weathered, scrap timber and corrugated steel, connected in a patchwork manner and roughly painted reddish brown and green to blend in with the autumn colours present during the duck hunting season. From time to time there are a few remnants of what one can only assume was a one stage a maimai. These twisted piles of wood and steel demonstrate the slow but relentless decay driven by the swamp.

The maimais are usually surrounded by open water and rely on timber piles for support. This method of connection to the ground...
results in a visible degree of sinking and tilting. There has been no attempt to explore different ways of connecting to the ground. The connection to the ground is often intentionally concealed by strapped on vegetation and deadwood.

Whangamarino DOC ranger, Kevin Hutchison mentioned that these structures are usually built so that the floor is above the water level for roughly 70% of the year. This results in horizontal bands forming on the outside of the external materials which show the various water levels that have existed in previous years. This prompted the idea to portray previous water levels on any new structures to be built in the wetland.
Another interesting tectonic precedent is Peter Zumthor’s Steilneset Memorial in Vardo, Norway. The memorial was designed to commemorate suspected witches that were burnt at the stake in the 17th century. The timber structure shape is derived from wooden fish drying racks that were once common to the area. These structures were primarily concerned with stability and usually used either an ‘A’ frame construction or included several bracing elements. Zumthor’s memorial uses bracing elements to achieve a physically stable structure. It gives the structure a trapezoid shape which appears visually stable. The stability is further enforced by the timber elements of the frame overlapping each other. The timber posts are connected to the ground by thin steel anchor rods. It was undoubtedly done to protect the timber from the moisture of the ground, but it furthermore lightens the structures visual connection to the ground.

The connection of the timber structure to the ground and the trapezoid shape may be useful in the wetland to demonstrate the unstable nature of the ground.
4.4 | The Joint

A key part of tectonics is the joint. Construction is only possible through the joining of various parts. There are various views on the role of the joint in architecture. The joint is often referred to as a detail.

Frampton places a great deal of importance on the joint. He picks up on Semper’s identification of the knot, or in our case the joint, as the primordial tectonic unit. Frampton concludes Semper’s position by stating “…the ultimate constituent of the art of building is the joint.”

Peter Zumthor further discusses the importance of details in his 1988 essay: A way of looking at things. He states that “Details express what the basic idea of the design requires at the relevant point in the object: belonging or separation, tension or lightness, friction, solidity, fragility.” Zumthor sees details as being part of creating a meaningful architectural object as opposed to solely addressing functional and constructional requirements.

In his paper The Tell the Tale Detail, Marco Frascari discusses the importance of the joint (or in his terminology the detail) for all tectonic undertakings. Frascari begins by reciting the famous maxim of Mies van der Rohe that “God lies in the detail”. He uses this to declare that details “can be regarded as the minimal units of signification in the architectural production of meaning.” Frascari’s aim is to promote details as generators in architecture. This is because “details themselves can impose order on the whole through their own order.” According to Frascari, the detail is always a joint and it can either be a joint between material things or a joint between forms. He explains that the detail “is the place where both the construction and the construing of architecture take place.”

This is the basis of Frascari’s claim that details are not only crucial for construction, but also play a part in the production of meaning in architecture.

Frascari discusses how the architect Carlo Scarpa employed working drawings to produce meaningful details. He concludes that Scarpa’s drawings “are a construing of perceptual judgements interfaced with the real process of physical construction of an architectural object.”

Frascari clarifies his view on perception through a discussion of the ideas of Hermann von Helmholtz and Walter Benjamin. Helmholtz takes the phenomenon of indirect vision, where only a small part of our field of vision produces clear images, to conclude that our sensory stimuli only provide us with signs (details). These details acquire meaning through a process of comparison and association, and through geometric relationships. Frascari also introduces Benjamin’s ideas of buildings being understood by use and perception or in other terms touch and sight. Our tactile experience is largely a result of habit and this habit in part determines our visual perception.

The role of the joint will be crucial in the smaller interventions that are situated in the wetland. In these situations the connection to the ground can be thought of as a joint. These texts agree that the joint can express non-structural and functional ideas allowing for a more meaningful connection.

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32. Ibid., 511
33. Ibid., 507
34. Ibid., 505
4.5 | Water and Architecture

The work of Italian architect Carlo Scarpa serves as a potent example of the amalgamation of water with architecture. Water appears in almost all of Scarpa's work. One of Scarpa's most notably aquatic endeavours is his renovation of the Querini Stampalia Foundation in Venice. The Querini Stampalia demonstrates how water can unify the transition between interior and exterior. It also serves as an interesting example of how the presence of water can influence the perceived connection architecture has with the ground. The successful incorporation of water in the Querini Stampalia relies in no small part on Scarpa's awe-inspiring use of architectural detailing and his skilful placement of materials.

The presence of water in Venice severs the connection the city has with the ground creating a visually perplexing floating city. The many canals introduce the presence of water all over the city further diminishing Venice’s connection to the ground. Furthermore the predominantly masonry buildings of Venice are not only physically but also visually heavy which further undermines the already visually absent connection to the ground. This no doubt plays a huge role in the majestic experience of Venice. Venice’s peculiar relationship with water becomes startlingly apparent when parts of Venice flood during a phenomena known as the acqua alta [high water] that usually occurs between autumn and spring. Scarpa was born in Venice and spent the majority of his life there. He taught at the Venice school of Architecture and also designed architectural works in the city. This strong connection to Venice is likely the reason behind Scarpa’s fascination of incorporating water as a design element in the majority of his architecture.
The original Querini Stampalia palazzo was a standard Venetian four story palace which was built between 1513 and 1523. In 1958 Scarpa was enlisted to renovate the garden and the ground floor, which had been damaged by the acqua alta. The Querini Stampalia is a public gallery and comprises of a foyer space, a porch space providing access from the canal, a centrally located exhibition space, two smaller rooms, a stairwell leading to the second floor, and a garden space at the rear.

The principal idea of Scarpa’s renovation was to allow the acqua alta to penetrate into the ground floor of the building and utilise it as a stratum that informs the design. Water from the canal is allowed to pass under the water gates into a recess where a cascade of steps rises up to an elevated walkway. A sheet of water resides in this recess and provides dappled reflected light from the canal to naturally illuminate the porch area and the main exhibition space behind. The cascading steps provide access via gondola into the building and also act as a gauge of the constantly changing water level of the canal. Once the water level rises to a sufficient height it eventually flows into channels that surround the elevated walkway. The channels separate the elevated walkway from the walls allowing a glimpse of the original floor level. When these channel flood, the water severs the elevated pathway from the lower floor level removing its connection to the building making the path appear to float.

The main method of entry is via a small timber and steel bridge that crosses the Rio Santa Maria Canal and enters through a hole in the façade that once served as a window. The bridge structurally relies on a steel arch that springs from concrete abutments at either end.

Figure 4.5.3 | The cascading steps

This ‘springing’ nature of the bridge gives it a sense of lightness. The foyer and porch areas are connected by an elevated walkway. Adjacent to the foyer space is the northeast room. Here Scarpa has preserved the original floor level and as such this room will be susceptible to flooding during a severe acqua alta. The elevated pathway terminates just as it enters this space offering a step off to the side to accommodate the transition in height. The awkwardness of this sideward transition is possibly an attempt to further emphasise the protection the pathway offers from a potential flood.

The floor level of the main exhibition space is lower than the elevated walkway. This drop in height is revealed by the floor material wrapping up the sides of the walls to the same height of the lip of the walkway (high water mark). Above this line the material changes to travertine. The main exhibition space opens out to the garden.
where an island of grass has been raised just above the high water mark. This increases the garden’s presence in the main exhibition space and further strengthens the association with water.

The different materials used by Scarpa further clarify the relationship of the various elements in the building to water. The top surfaces of the cascade steps are finished with a thick slab of polished travertine marble, perhaps an abstraction of the often smooth reflective surface of the lagoon. Below the marble is a rough concrete with exposed aggregate. The smooth marble with the rough finished concrete below not only accentuate the gauging ability of the steps but also visually represents the sectional nature of the changing water level. A similar effect is used on the elevated walkway where the top of the lip and walking surface are finished in marble whilst the outside is finished with an exposed aggregate concrete.

The Brion Cemetery is another building by Scarpa which demonstrates his approach to designing with water in a purely terrestrial setting. In the Brion cemetery, water is used to isolate various parts of the design in order to create private areas for meditation. Like the Querini Stampalia the combination of water and detailing is used to visually undermine the connection to the ground. The Querini Stampalia allowed the acqua alta to penetrate into the building and visually sever the connection of the pathway to the building making it appear to float. The pavilion in the Brion Cemetery demonstrates this same effect in a slightly different way. The columns that support the roof element of the pavilion emerge from the water surrounding the platform. As the platform is separated from the structure supporting the roof it becomes isolated and despite its concrete construction it appears to float in the pond. This floating effect is further enhanced by the edges of the platform just hovering above the surface of the water. Despite the shallow depth of
the surrounding water it still manages to sever the pavilions visual connection to the ground. The use of water and architectural detailing breaks the pavilion from its earthly connection creating a surreal meditation space. In summary it can be seen that Scarpa’s work deals with both the pragmatic and the poetic. The Querini Stampalia demonstrated Scarpa’s use of water as a horizontal stratum that informed the design of the ground level, the design of details and the selection of materials. As one moves through the building, various visual clues are left to hint at the constant changing relationship to the notional height of the acqua alta. In the wetland the variable water level could be used as a stratum that informs the design and creates additional layers of meaning. Architecture’s connection to the ground in the wetland could be visually severed during the flood events. During dry periods detailing could be used to leave visual clues to the potential height of the flood.

Figure 4.5.4 | The meditation pavilion in the Brion Cemetery
Water is present in the Whangamarino wetland in some degree throughout the year. In the summer months the visual presence of water is largely restricted to the streams, ponds and rivers. During the winter the increase in rainfall causes the wetland to dramatically flood. In order to grasp the scale of the flood it is necessary to visit the wetland during dry and wet periods. This raised the question of how this variance in water level could be conveyed to the one-time visitor. The flood was personally understood from witnessing the boat ramp car park covered by 2 metres of water. The car park provided a spatial experience of the effect of the flood by providing a reference point to gauge the volume and height of the flood water. The following precedents explore a similar idea.

“Panorama Landmarks” are a series of architectural interventions proposed by Mark Smout and Laura Allen in East Anglia. Smout and Allen’s aim was to create “sustained artifices” that rest in the site, “taking advantage and sometimes revealing the intrinsic qualities of the site.”

The landmark for the North Norfolk coast is situated on the margin between the sea and the land. Here Smout and Allen explore a few of the intrinsic qualities of this ever-shifting coastal landscape. The first part of the intervention is a series of ‘drift markers’ that stretch out into the sea and reveal the motion of the wind and the currents of the sea. The wind is revealed through a type of flag whilst the current of the sea acts as a rudder for the buoy like structure. On the beach lies the second part of the intervention. Here the shifting dunes are the intrinsic quality to be revealed. Smout and Allen’s approach here is to install a network of storage tubs, which get buried.
and revealed as the sand dunes shift throughout the year. Through the process of tubs being buried and revealed, the onlooker is given clues to the dramatic shifts of the sand dunes. The network of tubs provides a datum to grasp the drifting of the sand dunes.

Smout and Allen’s next landmark is a market situated in the marshland of Essex. The intervention is situated in the inter-tidal zone and consists of a shallow low lying plate. The raised market platform is perforated in order to engage and reveal the incoming and outgoing tide. The interesting part of this scheme is its location on the intertidal zone. This point arguably provides the most dynamic experience in the marshes.

Smout and Allen’s landmarks contain some interesting architectural ideas relevant to this project. The slow change in water level in the Whangamarino wetland may benefit from the ideas of utilising an architectural datum to help visitor gauge the water level change throughout the year. It may prove useful to locate the entry building on the edge of the wetland where the rise in the water level will translate into a horizontal shift of the edge of the wetland.

Figure 4.6.3 | Model of the market in the marshland of Essex

Figure 4.6.4 | Axonometric of the market
4.7 | Key Aspects from theory and precedents

Tectonics can be understood in a number of different ways. The connection to the ground can draw on these interpretations in order to enrich the experience and understanding of the Whangamarino wetland.

Eduard Sekler acknowledged that through tectonics the architect can intensify the experience of forces related to forms. In a wetland environment the structural difficulty of supporting the architectural interventions could be visually expressed in order to intensify the experience of the wetland ground condition.

Kenneth Frampton based his theory of tectonics on those of Gottfried Semper, and divided construction into the tectonic frame and the stereotomic mass. The stereotomic mass may be used to create a strong connection to the ground before entering the wetland. It would provide a strong contrast to the lighter connections to the ground required in the wetland.

Marco Frascari proposes that details can act as generators imposing their order onto the larger whole. For Frascari details are the place where construction and meaning are merged together. The detailing of the interventions in the wetland and their connection to the ground will play a crucial role in the experience and understanding of the wetland environment.

The idea of using architecture as a datum as demonstrated by Carlo Scarpa and proposed by Smout and Allen could be used to illustrate the actual and potential water level variation in the Whangamarino wetland.

The connection to the ground is only the beginning of the architectural experience. As the interventions rise from the ground they will respond to other influences in the wetland such as vegetation or spatial experiences.
Design Process

5.0
Central Peat Bog

Restiad Bog

Manuka Swampland

Pungarehu Bridge

Entry Intervention
5.1 | Overview

The journey into the wetland has been broken up into four interventions. The design process for each intervention will be discussed separately in its own section. The location of each intervention was chosen as each of them provided a different condition to architecturally respond to.

The first two interventions are required out of necessity. These are the entry intervention and the Pungarehu bridge intervention. The entry intervention resides on the edge of the wetland and is the point of arrival. This point provides the visitor with an overview of the mineralised swampland. For most of the year this area is predominantly covered by seasonal adventives and grasses. During high rainfall this whole area is often completely flooded.

The second intervention will be a bridge to cross the Pungarehu stream. The bridge will need to cope with a changing water level whilst also allowing year round boat traffic under it.

The third intervention is located at the start of the Manuka swampland. This intervention will need to respond to a variety of vegetation.

The last intervention is located in the restiad bog. This part of the wetland is the most ecologically important. The vegetation in this zone grows at a very slow rate and as such will require a careful ground connection.

The starting point in the design of each intervention will be its connection to the ground. The connection to the ground will be influenced by the changing water level and a variety of ground conditions. As the interventions rise from the ground they will respond to other conditions unique to their local environment, such as vegetation density or spatial qualities.

Figure 5.1.1 | Site plan outline the location of the Interventions
Figure 5.1.2 | Sketches of the four interventions
Figure 5.2.1 | View of the entry site during a flood
5.2 Entry Intervention
Introduction

The entry intervention is the largest of the four interventions and will be where visitors are first introduced into the wetland. The building is situated on a small piece of land just south of the Falls Road bridge. The principal traffic will come from the north of the site along Falls Road.

An important idea for this building was to explore a heavy connection to the ground in order to provide a strong contrast to the lighter connecting interventions situated in the wetland. Another important idea was to use the building as a datum to gauge the change in water level that occurs throughout the year.

Topography and Water level

The topography of the specific site was generated from the available 20m contour maps and refined through observations made during a number of site visits. The water level information that was available was inconsistent and a decision was made to generalise in order to commence with design.

The water level at the edge of the entry site varies throughout the year. In the summer months the water level is below the seasonal adventives and grasses in the mineralised swamp land. During the winter months the water level at the edge of the entry site rises roughly between 1 m and 1.5m. The maximum allowance for the water level is set at 2m.
Figure 5.2.3 | Site plan

- Bridge
- Boat Ramp
- Mineralised Swampland

[Site plan diagram with labeled areas]
**Initial Design Responses**

To initiate the design process two cross-sections were undertaken to explore an initial response to the site. These sections were undertaken prior to a more accurate understanding of the site and as such are slightly incorrect with regards to topography and water level variance.

The first idea [Figure 5.2.4] proposed a visitor centre that was largely constructed from concrete and was dug into the ground. A series of steps led the visitor down the site and onto a deck from which they entered the wetland. The main issue with this scheme was that the bulk of the building was positioned too far from the edge of the wetland. The building completely avoided engaging with the water.

The next idea [Figure 5.2.5] placed the building closer to the edge of the wetland. The trapezoid form from the Maori fortification precedent was included to give a strong visual connection to the ground. The building incorporated floor levels that stepped down the slope of the site. A wharf structure extended out into the wetland and eventually transitioned into a series of pontoons. These pontoons rose separately and each had slightly higher floats in order to rise in a stepped fashion. Each pontoon had two supporting columns that restricted the pontoon from drifting and also prevented the pontoon from grounding when the water level was low.

Both of the initial designs largely avoided engaging with the edge of the wetland and the changing water level. A further idea to explore was to overlap the pontoon structures with the fixed concrete elements of the buildings. This was explored further in the following designs. Following the initial designs it was decided to review orientation and general arrangement of the entry intervention.
Orientation and general arrangement

The mountain range along the eastern edge of the wetland provides a strong contrast to the flat landscape of the wetland. The mountain range generates a strong axis down this eastern edge of the wetland. This axis was used to establish a perpendicular axis on which to enter the site.

The axis provided a means to separate the two parts of the programme. The first part of the programme was the Department of Conservation area which would include an office and facilities for management and research of the wetland. The second part of the programme would be the public visitor area comprising of a cafe space, briefing area, and toilet facilities.

The DOC area was positioned to the north of the axis where a channel would be dredged to allow boat access to the Whangama-rino River and from there to the rest of the wetland. To utilise the channel, the kayaking area was also situated here. The visitor area would be positioned south of the main axis to capture the main vista down to the southwest.

In the two cross-sections undertaken in the initial design stage of the document, a viewing tower was positioned on the top of the visitor centre. In following design concepts it was decided to locate the viewing tower in the wetland to allow it to become a destination.
Trapezoid walls

The trapezoid walls from the initial design demonstrated a strong connection to the ground. A trapezoid wall could be used to reveal the axis identified in the previous section and separate the two parts of the programme. This wall along the axis could be used to provide a datum to gauge the water level. By placing two of these walls parallel to each other and placing a pontoon in the middle, the change in water level could be transformed into a spatial experience [Figure 5.2.8]. The changing water level overtime would stain the concrete trapezoid walls and reveal the previous water levels. The overlapping of fixed walls with the floating pontoons would also help to stitch the wetland with the building.
Design Concept 1

This concept explored arranging trapezoid walls and pontoons along the edge of the wetland. The trapezoid walls were arranged to direct views out to the surrounding landscape. These views introduced the wetland in stages as one moved through the building.

The main issue with this approach was that it required an excessive amount of walls. This resulted in the building being overly dominant on the site. The directing of views by the arrangement of walls appeared contrived and weakened the experience of viewing the wetland for the first time.

It was decided that a singular view down the previously mentioned axis would provide a more potent entry into the wetland. After the initial entry, the building could reference the surrounding landscape in a much more subtle manner.

Another issue was that some of the trapezoid walls were slightly tilted vertically to align with the slope of the site. This confused the simple idea of the walls forming a horizontal datum. It further undermined the walls connection to the ground as they seemed to bend to the will of the topography as opposed to embedding into the slope.
Design Concept 2

The next design broke with the strict orthogonal arrangement of the last scheme by angling the walls horizontally. The angling of the walls allowed the building to align with the shape of the site. The trapezoid walls were extruded back until they disappeared into the ground. The embedding of the trapezoid walls into the site creates a stronger connection to the ground.

The wall along the central axis was bent to the north in order to emphasise the expansive view of the wetland to the southwest. The programme is split by the central wall. The Department of Conservation area is situated to the north of the wall. A dredged canal would provide boat access to the Whangamarino River. Kayaks would be located here to provide an additional means of exploring the wetland.

A viewing tower was located in the wetland a short distance away from the main building. It had a double spiral staircase to separate the upwards and downwards pedestrian traffic.
As the visitor moves through the building there were a number of transitions required between the floating pontoons and the stationary concrete walls. The transition from the pontoons to the concrete walls was achieved through placing a floating pontoon alongside a concrete stair case. The water level determines the height at which the crossover onto the stairs occurs. The transition highlights the crossover from floating to solid ground. The steps disappearing into the water provide a further clue to the fluctuating water level.

Design concept 1 used walls to direct views to important features in the landscape. In this scheme the cuts in the wall are used to highlight views of the wetland. Figure [5.2.14] shows how a cut through the main wall directs the view to the Maori Pa site in the distance.
Design Concept 3

The third design further simplified the arrangement of the trapezoid walls. The previous proposals moved visitors down through the building in a meandering fashion. In this scheme a central decent down the established axis leads the visitor into the wetland. As was the case in the previous design, the northern trapezoid wall was bent in order to open up a view to the south west. This scheme explored stepping the trapezoid walls as they moved down the site. The stepping in the walls helped them to relate to the slope of the site, which in turn increased their visual connection to the ground. The walls emerge from the solid ground at the back of the building and provide a datum along the edge of the wetland before tapering down and disappearing into the wetland. At the bottom of the central stair the two main walls remain constant for a short period to establish the datum from which to gauge the water level. The cuts in the wall provide views to surrounding mountains to the north and south. As the water level rises the trapezoid walls are visually severed from each other breaking their dominance.

The transition down the main axis was achieved through a series of independently controlled pontoon steps that are guided by channels in the side of the two walls. These channels restrict the drop in height sequentially, but allow all the pontoon steps to rise up to the maximum water height. The channels cutting into the stereotomic wall was seen as an alternative way to describe the fluctuation in water level. The channels direct further attention to the subtle water staining of the walls.

The programme is divided by the central axis. The visitor area is located on the south side of the walls and offers extensive views to the south. To the north of the central axis are the Department of Conservation office and storage areas.
A decision was made to remove the tower from this concept and provide a viewing structure in the centre of the wetland. By placing the viewing tower in the centre of the wetland, it will become a separate destination that will lead the visitors into the wetland.
Developed Design

The third design concept showed the most promise and was selected for further development. The stereotomic walls provided a strong connection to the ground. An important area for further development was the junction from the stereotomic to the tectonic. This junction occurs both vertically and horizontally. As the stereotomic walls move into the wetland they will need to gradually transition to a tectonic frame construction.

The kayaking area and boat ramp were dropped from the scheme because the visitor centre is already in close proximity to the existing boat ramp. Aside from this, the general arrangement of the programme was kept.

The pontoon path was removed from the north side of the main wall as it was no longer needed. The southern wall was flared out at the bottom to enable views out into the wetland. The visitor centre and DOC area were constructed around secondary walls that protrude out from the central walls. The goal was to keep the buildings attached to the central walls without obstructing the expanding view from the central axis.

The visitor and DOC areas will need to be enclosed. The secondary stereotomic walls could rise and form a roof over the space required. However this would result in an excessive amount of concrete. It was decided that the tops of the secondary stereotomic walls would transition into a tectonic frame which would enclose the space.
The Maryhill Overlook precedent explored folding and cutting a stereotomic ribbon of concrete to enclose space. Manipulating the stereotomic wall in a similar way was used to allow the wall to gradually transition into the tectonic frame. The first sketches explored how the stereotomic walls could be shaped. A series of 3d models investigated the transition from the shaped stereotomic walls to the tectonic frame. The tops of the stereotomic walls were cut and extended out to provide the support for the tectonic frame elements. The idea was to keep the stereotomic walls formally simple and let the tectonic frame integrate. Figure 5.2.23 was the most successful as it allowed the tectonic frame to pass over the stereotomic wall on both sides which created a more balanced junction.
There were a number of different ideas explored to roof the doc and visitor areas. A single sloped roof opening out into the wetland did not suit the overall building and it was decided that the roofs should follow the formal stepping language of the stereotomic walls.

The horizontal transition from stereotomic to tectonic was emphasised by placing an additional wall behind [Figure 5.2.25]. This bunkered space will be used to house the toilet and kitchen facilities.
To prevent the buildings from being visible when walking down the central view shaft, the initial idea was to pull the building away from the wall. This however created an awkward space and detached the building from the central wall [Figure 5.2.26].

In the final design the building was pulled up against the wall but kept low in height adjacent to the wall to remain hidden from the central axis [Figure 5.2.27].

The north facing outdoor seating area is part concrete and part timber deck. The concrete floor transitions into a timber deck to further illustrate the transition from a stereotomic connection to a tectonic connection to the ground.
Figure 5.2.29 | Final Entry Intervention
Figure 5.3.1 | Location of the Pungarehu Bridge Intervention

5.3 | Pungarehu Bridge
Figure 5.3.2 | Section through Pungarehu Stream
The second intervention is the bridge crossing the Pungarehu stream. The stream cuts through the mineralised swampland and is visible from the entry intervention. The bridge is situated just south of a junction in the stream in order to engage with a larger expanse of water [Figure 5.3.3].

The streams and rivers in the wetland experience the greatest fluctuations in water level. During the summer months, when the water levels are low, the Pungarehu stream is clearly defined with 1m embankments on each side. During a flood event the water level can rise up to a maximum of 3m above the low water level. When the water level rises by just 1 metre the usually clearly defined edges of the stream are submerged.

The bridge needs to accommodate year round boat traffic with a minimum clearance of 2m.

Figure 5.3.3 | Site plan of Pungarehu Bridge Intervention

Figure 5.3.4 | Photograph of the Pungarehu Stream
The initial concept was for a fixed bridge. The bridge was made narrow and light to emphasize the crossing over the stream. The transition from the pontoon paths to the bridge was achieved by floating a pontoon adjacent to a fixed stair. Two timber beams extend out from each side of the bridge, interlock in the middle and are fixed together by a steel sleeve. This exposed junction emphasizes that the bridge is the meeting of two separate parts. The main issue with the fixed bridge was that it needed to be very high in order to accommodate boat traffic during flood events. The extreme height of the fixed bridge made it appear dominant and out of place in highly visible and open part of the wetland.
The final concept explored a floating bridge which would allow for a lower overall height. The floatation was enabled by the use of pontoon barrels which were kept visible in order to emphasise that the entire bridge is a floating structure. The middle section of the bridge was made narrow to enhance the experience of crossing the stream.

Several concrete columns are used to guide the rise and fall of the pontoons and prevent the bridge from drifting away. The concrete columns will also stain with watermarks that will indicate the previous heights of water in the wetland. The use of concrete for the columns emphasises that they are the only bridge elements that are fixed to the ground. The concrete columns that guide the bridge are extended up to the maximum possible height that the bridge can rise to. This establishes a datum which allows the visitor to grasp the potential movement of the bridge. The timber columns that guide the pontoon paths also extend up and indicate the maximum height the path will reach. The pontoon paths that lead to the bridge are broken into several segments that move independently. This allows the paths to settle during low water levels and form steps down the 1m embankment.

The columns of the bridge and immediate surrounding pathways create a visible marker of the maximum water level in the wetland. Throughout the year the appearance of the bridge will change as more or less of the columns are exposed. The connection to the ground is forceful in summer with an arcade of tall columns visible. During the winter high water period the columns will be significantly shortened and the connection to the ground will disappear.
Figure 5.4.1 | Location of the Manuka Swampland Intervention
Figure 5.4.2 | Section through manuka and swamp coprosma junction
Introduction

The Manuka Swampland intervention is located on the junction between the 2m high swamp coprosma belt and the 3-4m high manuka belt. This area was chosen as it had two contrasting conditions. The swamp coprosma belt is extremely dense while the manuka belt is relatively easy to walk through with only the trunks of the manuka trees visible. The manuka belt is enclosed by a dense canopy while the swamp coprosma belt is open to the sky. The ground is visible in the manuka belt but it is obscured in the swamp coprosma belt by a variety of low vegetation. The maximum water level in this part of the wetland will be 0.7m above the ground.

This part of the wetland was understood as consisting of two opposing spatial qualities: areas of immense expanse and areas of dense and enclosing vegetation. These spatial qualities were translated into an expansive outwards force and a compressive inwards force and expressed through tectonics and details.

The intervention will be divided into four segments that will each explore a different way of interacting with this part of the wetland. The four segments will be spread across a variety of conditions. The various conditions will inform each segment’s tectonic detailing and its connection to the ground.

The design of the segments will pick up on Marco Frascari’s idea of details being the minimal units of signification. Details will be used to recreate the perceptual judgements of the ground and surrounding conditions to enhance the experience for the visitor.
The first segment starts in the swamp coprosma zone. There are three primary impressions that arose from the site visit. The first was the low vegetation obscuring the ground plane. The second was dense vegetation making it difficult to walk through. The final observation was the seasonal presence of water.

The obscured ground plane led to the idea to conceal the ground connection. The dense 2m high vegetation gave rise to the abstract concept of horizontal compression. The seasonal presence of water prompted the idea to use pontoons in order to keep the path as low as possible throughout the year. These ideas were explored through a series of models. The models investigated how various elements could be compressed or clamped together and how the supporting posts could be inserted into slots that cut into the path. The aim was to create a path that is perceived as compressing inwards.

The strategies developed from the models were used to inform the design of the path. The path used helical piles to connect to the ground. The shaft of the helical pile was extended 0.7m up from the ground to indicate the maximum water level height. From here a small timber post extended up to the height of the vegetation to emphasise the narrowness of the path. The path was kept to a width of one person to further emphasise the experience of the horizontal compression. Pontoons are situated underneath the path to allow it to float when the water level rises. When the water level subsides the path rests on a horizontal member that sits between the piles. The narrow width of the path would not allow two people to pass each other. The solution was to incorporate a number of wider points along the path to provide a place where people can pass each other.
Figure 5.4.8 | The final path

Figure 5.4.9 | The compressive details of the path

Figure 5.4.10 | The wider points along the path
The next segment of the intervention is a viewing platform situated above the swamp coprosma belt. The viewing platform will provide an expansive view over this area which is in contrast to the horizontal compression conveyed in the path below. The idea of an expansive joint was explored through a series of models and sketches. This led to a strategy where the timber elements in the joint were pulled away from each other and connected with thin steel rods.

The viewing platform is permanently connected to the ground by four timber posts which sit on steel brackets that are attached to helical piles. The steel piles protect the timber posts from water damage and visually lighten the connection to the ground. Steel rods are used to separate the roof and the floor from the thicker timber elements. The stairs widen as they lead up to the platform and also use steel rods to separate each step from the supporting timber element. The expansive joining of elements visually renders the structure as expanding outwards.

The platform follows the idea of expansion by angling outwards separating into two levels. The platform directs a view to the eastern mountain range. The mountain ranges provide a marker for the visitors to orientate themselves after walking through the dense swamp coprosma zone.
The third segment of the intervention is situated on in the manuka zone. The manuka zone is in strong contrast to the coprosma zone. The previous segments obscured the connection to the ground due to the dense vegetation hiding the ground surface. In the manuka zone, the ground surface is visible which allows for a more expressive connection to the ground to be explored. The peat ground makes supporting any structure difficult. Helical piles address this issue of support, but with little or no expression. The primary idea for the third segment was to explore an exposed connection to the ground that spreads the load and rests on the surface rather than drilling into the ground. This idea was explored through a series of models.

The first models explored spreading the load across a large area through the use of a lattice structure that rests on the ground. The uneven ground condition in the manuka zone would make this approach difficult. The more successful models used a tripod structure to spread the load to a number of points. A tripod is more suitable to adapting to an uneven ground condition.

A unit of the pathway is supported by two tripods on either side. Each tripod consists of a timber leg facing outwards and two smaller steel legs facing inwards. Each leg is adjustable to cope with the uneven ground surface. The pathway was kinked several times in order to provide a view of the supporting structure underneath.
The last segment rises up to the manuka canopy. The supporting structure will need to physically and visually provide adequate support. The connection to the ground will build on the previous ideas of spreading the load but will need a much sturdier construction that is fixed down to the ground. The tripod structure worked well for the low pathway but as the structure rose in height the tripods had to become larger and their legs began to interfere with each other. It was decided that a trapezoid structure would provide the necessary support and not appear as cluttered.

The canopy path continued with the ideas of horizontal compression and expansion from the previous segments. The idea was to use the manuka canopy as a mediating layer that informed the path. The manuka canopy creates an undulating surface. The pathway was designed to mimic the undulating nature of the canopy by stepping up and down as it moves through and above the canopy. As the path rises into the dense manuka canopy the width of the path is narrowed and the supporting structure is compressing in on the path. The narrow path reinforces the density of the canopy for the visitor. As the path rises out of the canopy it becomes wider and the supporting structure moves to the side of the path. The widening of the path emphasizes the expansive view over the canopy that the visitor will begin to experience.

As the path rises, the height of the timber posts is maintained at the mid-level of the canopy layer. The consistent height of the timber posts provides a datum that helps the visitor to gauge his elevation. Once above the canopy the supporting structure is moved underneath the path to obscure the connection to the ground and create the impression that the path is part of the canopy. The platform follows the same idea in obscuring its supporting structure. The lack of a visual connection to the ground will reinforce the understanding of the canopy as a surface. The platform will have little detail aside from a handrail in order to allow an unhindered view over the canopy to the surrounding wetland.
Figure 5.4.23 | The supporting column providing a datum

Figure 5.4.24 | The path becomes wider as it rises through the canopy; the supporting structure is obscured
Figure 5.5.1 | Location of the Restiad bog Intervention

5.5 | Restiad Bog Intervention
Figure 5.5.2 | View from the Restiad Bog to the eastern mountain range

Figure 5.5.3 | Location of the tower in the Restiad Bog
The last intervention is situated in the restiad bog and will consist of a viewing tower which will be the end of the journey into the wetland. The restiad bog is a particular valuable part of the wetland because this type of wetland is rare in New Zealand. The low nutrient and high acidic ground condition in the restiad bog causes the vegetation in this area to grow at a very slow rate and takes a long time to recover if disturbed. The structure will have to take into account the fragile nature of the vegetation in this area by keeping damage to a minimum.

The substrate of the restiad bog is peat and therefore the tower will require extra support to be stable. A large ground connection has to be avoided as it will be impossible to bring the necessary machinery. On the other hand a spread out array of smaller footings would cause less damage to the vegetation but would still impact a large area. The solution would be a compromise between the two.

A rough height of 7m was decided for the tower as it allowed views over the 6m tall Manuka that surrounds the restiad bog area. The tower is situated in the northern part of the restiad bog and provides a view to the south of the extent of the bog. To avoid damaging the restiad bog the path was kept in the encroaching Manuka zone as long as possible.

An early idea was to use a footing that spread the load across the surface of the ground. This would provide adequate support for a tower but would trample a large amount of the vegetation. It was instead decided that the best approach would be to split the load above the ground and only bring a small number of splayed out points down to the ground.
A tripod structure was considered as it would spread the load to three points allowing each point to have a smaller footing. The tripod structure would however make the vertical circulation and planning of the tower difficult. A four-footed structure was chosen as it spread the load to four points and the square form made the vertical circulation easier to arrange.

The four points of contact will require fixing to the ground in order to provide a stable base for the tower. The fixing is best achieved through the use of helical piles as they are relatively easy to install and therefore keep damage to a minimum.
The issue with simple four-footed tower structure is that it can be too symmetrical. Two methods were used to break the symmetry of the four columns. The first was to introduce a kink into each column at a different height. This gave the structure a more interesting form that changes when viewed from different angles. The second idea was to arrange the stairs in an asymmetrical manner. The idea of kinking of the columns was then combined with the asymmetrical arrangement of the stairs. The stairs would wind up the inside of the structure and the columns would kink to provide space for a landing between the flights of stairs.

The structure of the tower had quite a bit of empty space and was unnecessarily wide [Figure 5.5.8]. It was decided to pull the columns closer to the centre of the tower to give the impression of a slender form and a wider and stable connection to the ground. The narrowing of the tower also provides a sense of compression for the visitor while walking up the stairs. This experience of compression or restriction provides a strong contrast to the expansive view at the top of the tower.
To further enforce the feeling of compression the stairs were made steeper and narrower with the final flight of stairs changed into a stepped ladder. Further compression was created by enclosing the tower in timber slats. The timber slats feather out to create a softer transitions to the spread footing at the base and the expansion at the top.

The platform allows a 360 degree view of the wetland. The floor plan focuses viewing in three directions. The first view is towards the restiad bog to the south. The second view looks to the east to where the journey into the wetland started. The third view is towards the north and provides the full overview of entire wetland.
Conclusion
Figure 6.1.1 | The final entry intervention
Conclusion and Critical Appraisal

This research project explored how architecture’s connection to the ground could enrich the visitor’s experience and understanding of the Whangamarino Wetland.

The diversity of wetland types encountered on several site visits provided a range of conditions that influenced the connection to the ground. In the wetland the ground, the water and the vegetation are inextricably linked. The architectural interventions needed to acknowledge and respond to each of these factors.

A variety of connections to the ground were developed into an architectural project which created a unique journey for the visitor to experience. The project attempted to show that the connection to the ground could be much more than just a practical necessity. It can be not only the starting point in the design process, but can inform other design decisions.

Several different strategies were identified in which the connection to the ground could enhance the experience and engagement with the wetland.

Early on it was realised that due to the precarious ground conditions in the wetland, the types of connection to the ground would be limited to medium and light structures. The entry into the wetland was identified as a place to explore a heavier connection as it was situated on the edge of the wetland with half the building resting on solid ground. Semper’s and Frampton’s division of building into stereotomic and tectonic construction proved valuable. The use of stereotomic trapezoid walls established a strong contrast with the lighter connecting interventions situated in the wetland.

The heavy connection at the entry into the wetland could be have been further emphasised by having parts of the entry building dug into the ground. The visitor could have been physically placed underground to create a greater contrast.

Tectonic expression was used throughout the project to convey
structural ideas of load and support. The idea of spreading the load of the structures down to the ground proved to be a successful way to illustrate the precarious nature of the ground. In certain areas, such as the canopy walkway, tectonic expression of load and support was obscured to create structures that visually detach from the ground to emphasise the canopy as a surface.

Eduard Sekler’s idea of tectonics making visible forces in form was expanded on to allow spatial forces to be conveyed through tectonics. The wetland was understood as consisting of two opposing spatial qualities: areas of immense expanse and areas of dense and enclosing vegetation. These spatial qualities were translated into an expansive outwards force and a compressive inwards force. The design of the interventions reinforced the spatial quality of each particular area by using either the idea of compression or expansion in the way elements were joined together and connected to the ground. Compression was implemented through pushing elements into each other. Expansion was achieved by separating thicker elements by thin steel rods. This approach provided a way to emphasise the spatial quality of a particular area and create a strikingly different experience for the visitor.

Model making proved a useful technique to explore joining parts together and judging the perceived result. In Marco Frascari’s terminology modelling allows for the construing of perceptual judgements with the process of construction. His idea of details creating meaning proved an effective technique throughout the project. A further investigation into the perception of tectonics and detailing, which was briefly discussed in the theoretical section, may have added further depth to the project.

A further area investigated, was how the connection to the ground could form a datum for the visitor to either gauge the variable water level or to emphasise levels of vegetation. The staining of the
stereotomic trapezoid walls at the entry into the wetland provided a powerful way for the visitor to understand the potential volume of seasonal flood in the wetland. When the wetland floods the partly submerged walls will indicate the temporary nature of the water level. Another way to make the visitor aware of the variable water level was to create an abrupt transition where the visitor was required to step from a floating pontoon onto a solid wall. It was later realised that even the subtle variances in ground elevation could have been revealed through the use of a datum. Although the wetland appears flat it does in fact vary in height by a few metres and the establishing of a datum could have been used to communicate this variation to the visitor. The datum could have also been useful in unifying the separate interventions. However the main barrier to incorporating ground elevation into the project was the lack of information available in this area.

Throughout the project designing with the connection to the ground as the central driver proved challenging yet rewarding. On several occasions the project drifted away from the central topic of connection to the ground. Finding relevant literature and precedents was also difficult. The connection to the ground is not a particularly well discussed area in architectural theory and the majority of wetland precedents are functional in their connection to the ground. The final design demonstrates that by creatively engaging with the diverse ground conditions in the Whangamarino wetland the visitor's experience can be enhanced.


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8.0 | Final Presentation
Key

1. Covered Storage
2. Workspace
3. Department of Conservation Office
4. Meeting Area
5. Bathroom
6. Kitchen
7. Public Toilets (male)
8. Public Toilets (female)
9. Kitchen
10. Display Area
11. Cafe'
12. Briefing Space
13. Car park

Visitor Centre // Interior

Visitor Centre // Elevation

Visitor Centre // Axonometric
Viewing Tower // Physical Model 1:20

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