COASTAL CALLBACK

“Coastal Callback”

An Architectural research project exploring the fundamental relationship between New Zealand’s Built and Coastal Environments.

Master Thesis Explanitory Document

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Abstract.

This research project, Coastal Callback, explores the delicate relationship that exists between New Zealand’s built and coastal environments. New Zealand’s Coast is vitally important to our country and is very valued by our nation. Growing populations and expanding urban landscapes are creating enormous pressures on our coastal areas and precious ecological environments.

New Zealand faces a dilemma as our coastal environments are becoming dangerous and more difficult to live near due to our misunderstanding and lack of knowledge and respect towards the coast. Architecture offers a possible solution to this problem. Architecture has the ability to create a mutually beneficial relationship between civilization and our precious coasts. This project becomes a tool and method by which human awareness and respect of the coast is increased through an educational experience.

Acknowledgments.

I would sincerely like to thank the followingpeople for their input into this project:

My family, for supporting me over the last 5 years morally, emotionally and financially.

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COASTAL CALLBACK.

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Figure 1.1 Sketch image of Lighthouse withstanding a storm.

1.0

Introduction.

The Coast is an integral part of New Zealand's culture and provides many people with great joy. However, in the short history of European settler's time in New Zealand, our fear and respect for the coastline has diminished. We have an increasing desire to live near to the coast (for recreation, sport, landscape beauty, retirement, and a sense that the coast is a healthy environment to occupy) that conflicts with many of the realities of that environment. This greater connection has bought upon us serious consequences. The coastline is a place to be reckoned with – strong winds, powerful waves, changing tides and shifting landscapes are all aspects of the coastline which have the potential to inflict damage on our built environment. Part of the problem is that people are generally unaware of the true power of the coastal environment, and how dangerous it really can be.

This Research seeks to explore mechanisms which will help guide and create greater awareness of the dangers, and possible consequences the coast has to inflict upon our built environments, using architecture as a means to exploit and expose such dangers.

1.1 Aims and Objectives.

The Purpose of this project is to provide a sustainable and responsive design solution which provides education and creates awareness of the importance of our coastal environment, and the potential dangers of building on the coast.

The relationship between the built and coastal environments of New Zealand is out of balance, and as a growing society we are expanding our occupation of the land in places which cannot be sustained. This project will examine the implications and effects of building in such environments. It will explore how architecture can exhibit the power and forces of such locations, creating in depth knowledge and understanding which will ultimately change people's attitude towards the coast.

It is important to understand that this project is not about creating a solution to building by the coast, but it is about creating awareness of the issues, and showcasing the natural elements (wind, tide, swell, sea level rise, storms) and their effect on building structures. This project will deliver a powerful impact on our human senses, using what we see, hear, smell, touch, and taste to evoke complete understanding of the coastal conditions, and their effect on our buildings. Elements of this facility will react and respond to the changing environment by physically moving, opening and closing, creating and retaining energy to explain and educate about the power, and importance of the surrounding coastal environment.

The challenge is not to create a design solution in response to changing climatic conditions. The real challenge is to create human awareness and understanding of the fragile coastal environment, and the impact and dangers of building in such places. Any design outcome will have some effect on the coastal environment. Whether this effect will be positive or negative, beneficial or destructive, is a judgement that can only be tested in a full-scale experiment, but the project, as a theoretical prototype is an opportunity to explore and discover a new way of designing around our coasts.

The project becomes a Coastal Awareness Centre.

1.2 Scope and Limitations.

The scope of this project is confined to developing an architectural model that creates awareness of the issues, rather than creating solutions to them. For centuries there have been solutions to 'resisting' and 'withstanding' the power of the coast – a lighthouse for example. A lighthouse stands strong and firm in its position and faces almost anything that comes towards it. This is not what this project is aiming to do, and it needs to be clear that the focus of the project is to showcase the coastal conditions, create understanding of the potential power the coast has on our buildings and educate people that the coast should be treated with respect and caution.

1.3 Focus / Challenge.

The Focus of this project is the relationship of our built environment to the coast of New Zealand.

The challenge is not to create a design solution in response to changing climatic conditions and future proof our buildings – The real challenge is to create human awareness and understanding of the fragile coastal environment, and the dangers of building in such places.

Any design outcome will have some form of effect on the coastal environment; whether this effect will be positive or negative, beneficial or destructive, is what will be examined. This project is an opportunity to explore and discover a new way of designing for our coastline. The potential to impact the way we do things with respect to our treatment of nature's resources makes this an exciting and thought provoking challenge.

Figure 1.2 House threatened by eroding cliff - Norfolk, UK.

1.4 Methodology.

This research project will use two types of research methods; research 'for design', and research 'by design'. Problems and questions will be identified throughout the project which will result in relevant architectural solutions.

Within this general approach, quantifiable methodologies will be used to establish primary data relating to site, climate, local coastal conditions, and will be extended into areas of factual marine information, such as pollution data and general oceanic ecological research. Most of this information is sourced from government reports and published studies, including local and international web sites.

The research 'for design' phase will include critical analysis of precedents and literature based on the coastal environment of New Zealand including its materials, species and relative landscapes to gain understandings of context. The project will evolve as the understanding of the fundamental relationship between the built and the natural environments can be translated into an architectural project. Research into how built form is affected by natural elements such as wind, water and light will also need to be looked into to enhance my understanding of the implications built form for these elements. Selected literature extending from official reports and government policy statements will inform this part of the research: architectural priorities are not usually closely aligned with marine research studies.

Following selection of the most appropriate site for this study, at Mt Maunganui, site survey research will be based on GIS and coastal data, and will be informed by site inspections at different seasons and tidal conditions. A short history of the site is important due to pre-arrival occupation of the island by local iwi and Hapu; and later use of it, up to the present, by mainly holiday-related activities.

A literature review using library and internet-based material will provide a base of information for precedents in this field, selecting examples and models that reflect as far as possible the objectives stated above. This element of the research process will include analysis, as far as time permits, of coastal change resulting from environmental impacts, particularly in situations that resemble conditions on the New Zealand coastline. The impact of, for instance, oil spill damage as a hazard of all marine environments is an area of study that has direct relevance to this site; but long term industrial pollution (such as is seen on northern European coastlines) is less significant.

This leads to research 'by design' which is the fundamental 'design phase' of the project. It involves a creative process of analysing the acquired information leading to a relative design response. The questions and issues raised through the initial research will be resolved through the use of various methods including sketching, diagrams, physical modelling, 3D computer modelling and documentation.

Ultimately, this will lead to an intellectually complete, appropriate and responsive architectural design that contributes to a better understanding New Zealand's beautiful coastal environment.

Figure 1.3 Caves at Mercer Bay - West coast of North Island, New Zealand.

1.5 Research Question.

How can architecture help create awareness and understanding of the changing coastal environment of New Zealand?

Awareness:

The concept of Awareness, is something that is lacking in today's society with regards to care and respect towards our coastal environments. The engagement of human senses, as has been mentioned above, has a key role in developing a deeper understanding of our relationship to the marine environment.

Awareness is defined as: "The state or ability to perceive, to feel, or to be conscious of events, objects, or sensory patterns. In this level of consciousness, sense data can be confirmed by an observer without necessarily implying understanding. More broadly, it is the state or quality of being aware of something. In biological psychology, awareness is defined as a human's or an animal's perception and cognitive reaction to a condition or event."[1]

In July 1999 the Education and Public Awareness Unit was established by the 'Coastal Zone Management Authority and Institute' (CZMIA). The goal of the programme is to increase and improve the knowledge and understanding of issues affecting the coastal zone, therefore better preparing communities to make informed decisions on the use of the coastal and marine resources.[2]

The goal of this project is to increase and improve knowledge and understanding of issues affecting the coastal environment, which will therefore educate people to make informed decisions on the use of the coastal and marine resources.

1 "Definition of awareness" http://en.wikipedia.org/wiki/Awareness (accessed on 25.05.14)

2 "Coastal Zone Management" http://www.coastalzonebelize.org/?page_id=64#sthash.csudWWU8.dpuf (accessed on 13.07.14)

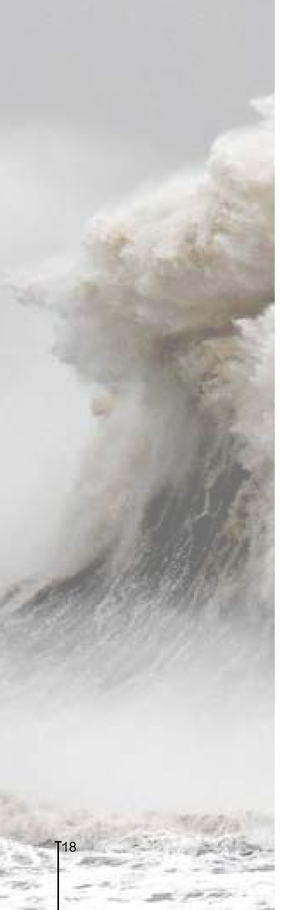


Figure 2.1 Waves crashing in Storm. http://binscorner.com/pages/l/lighthouse-vs-waves.html

2.0

The Project.

Overview of the problem:

With a focus on creating awareness of coastal issues, it is useful at this stage to identify and outline what those issues are. An examination of the context and the way we have historically designed around New Zealand's coasts is important because the coast has been inhabited since our earliest occupation, and numerous forms of coastal use have been tested previously. This includes identifying the contrast of both the East and the West coasts, as they are typically treated very differently, both in terms of design, and our human attitude toward each. Following this, the challenges (natural and human) and the strategies in response to the challenges are identified are explored. The strategies in response to the challenges are important to give the project identification and purpose. The application of these strategies will be fundamental contributors to creating awareness of coastal issues and (potential) complications of building in such environments.

2.1 New Zealand's Coastline.

The Coastline is where land meets the ocean, where the built human environment meets the natural world, and with this come many complications - both physically and socially. "Nature is always right, mistakes are made by people".[3] "Right" in the sense that nature can't be right or wrong (morally) as it can only be what it is – benign, sometimes, rough and dangerous at others. Human "mistakes" are misjudgements about what nature is.

As previously mentioned, the coastline is an integral part of New Zealand culture. New Zealand is ranked 9th in the world for its length of coastline with a total of 15,000km[4]. With such a coastline (relative to the overall land mass of New Zealand) it becomes a very important part of the country's environment.

As New Zealanders we are raised by the coast and ensuring that peoples attitudes towards it are respectful and well-informed, is of primary concern. From the years 2009-2013, an average of 108 people have died from drowning in New Zealand each year[5]. Water Safety New Zealand (WSNZ) says; "We are committed to lowering the drowning toll through leadership, awareness and education."[6]

3 Schafer, Robert. "Coastal Strategies." *Topos Journal 88*, 08 2014: 3.
4 "public Access to the New Zealand Coast" http://www.doc.govt.nz/Documents/science-and-technical/docts10.pdf (Accessed 12.04.14)

5 "Water safety New Zealand" http://www.watersafety.org.nz/ (accessed 10.04.14)
6 Ibid.

Rank	Country	Land area[3] (km²)	Coastline[4] (km)	Coast/area ratio (m/km²)
–	*World*	148,940,000	356,000	2.39
1	Canada[5]	9,984,670	202,080	22.22
2	Indonesia	1,811,569	54,716	30.20
–	*Greenland*[Note 2]	2,166,086	44,087	20.35
3	Russia[6]	16,377,742	37,653	2.30
4	Philippines	298,170	36,289	121.71
5	Japan	364,485	29,751	81.63
6	Australia	7,682,300	25,760	3.35
7	Norway	304,282	25,148[Note 3]	82.65
8	United States	9,161,966	19,924	2.17
–	*Antarctica*	14,000,000	17,968	1.30
9	New Zealand	267,710[7]	15,134	56.53
10	China	9,569,901	14,500	1.52
11	Greece	131,957	13,676	104.68
12	United Kingdom	241,930	12,429	51.37
13	Mexico	1,943,945	9,330	4.80
14	Italy	294,140	7,600	26.00
15	Brazil	8,459,417	7,491	0.89
16	Denmark	42,434	7,314	172.40
17	Turkey	783,562	7,200	9.40
18	India	2,973,193	7,000	2.00
19	Chile	743,812	6,435	8.65
20	*Croatia*	55,974	6,268[8]	104.20

Figure 2.2 Table of Lengths of Coastline by country.

Figure 2.3 West Coast Beach, Mercer Bay, Auckland.

West Coast.

The west coast is exposed to a vast area of ocean and faces the majority of New Zealand's South West (SW) prevailing wind. It is rough, exposed, and open to the elements. Black sand covers the beaches whilst soft rock is constantly falling off the cliff edges due to erosion from the constant pounding of wind and waves. Such exposure to the elements has a strong effect on materials causing deterioration at considerable rates and because of these conditions, it is very difficult to build and to live on this coast. We design protectively on the west coast, creating shields, hideaways and shelters. The West Coast is seen as some of New Zealand's roughest environments; these conditions determine how we should build, and we build accordingly. It's Beaches are beautiful, yet need to be treated with caution.

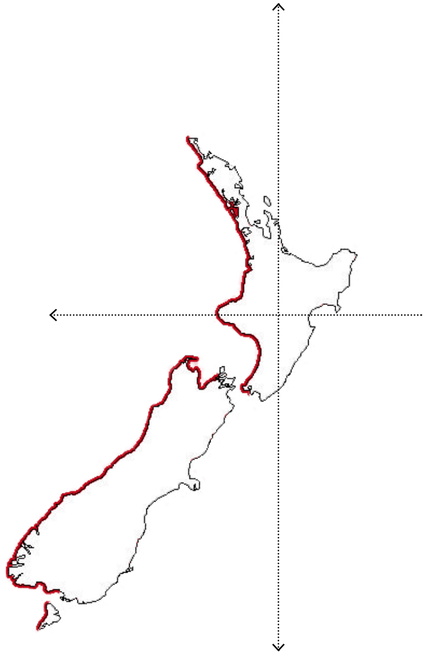


Figure 2.4 New Zealand Map, West Coast highlighted.

Figure 2.5 West coast beaches of New Zealand. Showing black sand, soft rock, steep cliff edges and wild seas.

East Coast.

New Zealand's East Coast consists of almost 7000km of coastline[7] and is the location of the majority of New Zealand's Harbours and marinas. Generally calm, controlled and protected it is considered to have some of the most beautiful coastlines of the world. The geology of the east coast is quite the opposite to that of the West coast. With white sand, compacted rock, sloping beaches and lots of greenery, the east coast is often sheltered and welcoming to both people and natural growth. We build differently on the east coast, as it allows us to. We open our homes and work places out to the elements, exposing everything we can to maximise both views and sun aspect. This however, can be a misconceived approach to building and in turn is where many of the problems are occurring.

7 "About New Zealand" http://www.nzs.com/about-new-zealand (accessed 24.05.2014)

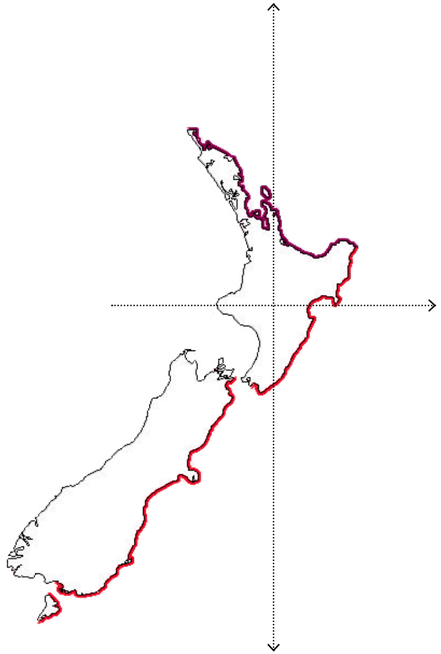


Figure 2.6 New Zealand Map, East Coast highlighted.

Figure 2.7 East coast beaches of New Zealand. Showing white sand, compacted rock formations, and calm harbous.

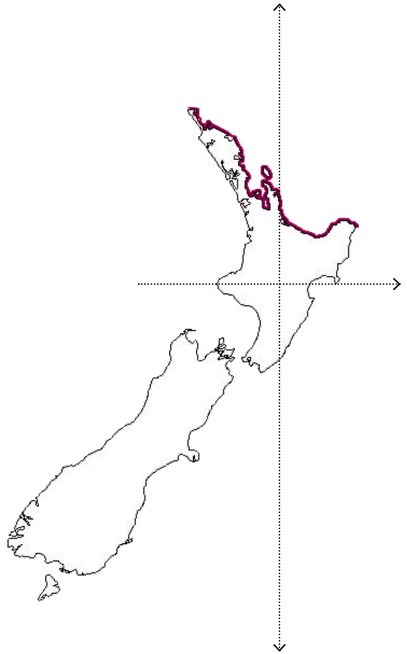
Figure 2.8 Small Bach lost due to Erosion.

Figure 2.9 New Zealand Map, North East Coast Highlighted.

New Zealand's Coastline - Conclusion.

New Zealand can be considered to have two main coasts, with the biggest threat to human coastal occupation more on our North East coast of the North Island than elsewhere. This part of the coast is beautiful and sought after, and there has been huge expansion of habitation in these areas. With this, an urge to be as close to the coast as possible is pushing buildings to the limits, and resulting in vulnerability through exposure to nature and its unpredictable power and ability to destroy.

The majority of coastal conditions are calm and protected by landforms: commonly, buildings in these areas are designed with minimal protection and maximum exposure to the elements for reasons of amenity. But if this exposure coincides with a series of storms and rising sea levels, these areas become endangered. This exposure cannot be sustained and we are running the risk of destroying our buildings, our coastline, and putting people's security at risk. Either we Retreat from the coast or we Re-think the way we design and build in these areas.



2.2 Challenges.

This section explores the challenges that need to be addressed when building near the coastline. Each of these challenges presents potential threats which can cause major damage to both built infrastructure and to the occupants. Changing weather patterns, sea level rise, erosion, and destruction caused by storms are explored. Secondly, exploration into the psychology of people's attitude towards the coastline (which becomes a major challenge with this project) will be discussed. These challenges will need to be addressed architecturally in a manner which creates awareness, understanding and respect to the power of nature's forces.

2.2.1 Natural Challenges.

Nature needs to be respected and understood as a powerful force in this environment.

Wind, waves, tidal movements, and storms are all elements of the coast which we have been trying to deal with for generations, but often without the right knowledge, respect or understanding about them to really design correctly. The natural environment is constantly changing, never static, and does not let anything get in the way of its movements.

This section looks briefly at some of the main issues arising around our coastlines, including the causes, and possible ways to respond to these issues, with particular focus on sea level rise, erosion and storms.

Sea Level Rise

Sea level rise is one of the driving factors of re-thinking the way in which we design near and on our coastlines. For around 2,000 years sea levels remained relatively constant. Between 1880 and 2011, however, they rose by an average of 0.07 inches (1.8mm) a year, and between 1993 and 2011 the average was between 0.11 inches (2.8mm) and 0.13 inches (3.3mm) a year[8]. Similiar studies predict that by the year 2100 the sea level will have risen by an average of 0.8m. [9] Although this doesn't seem like a huge amount, many low lying countries and cities will be submerged by this global event.

There are numerous theories on what is causing sea level rise, and also ways in which we can delay or inhibit its occurrence. The main issue however, is that its occurrence is inevitable, and therefore we need to plan to mitigate its effects on our built environment, and create awareness and knowledge to change the way we approach coastal development.

Having knowledge and understanding of what is causing sea level rise is very important with this project, as in order to teach, the knowledge needs to be first understood by the teacher. In this case, the design in architecture will be teaching and educating the issues of sea-level rise to the visitor.

8 "Coastal Cities and Climate change"http://www.economist.com/news/unitedstates/21579470-americans-are-building-beachfront-homeseven-oceans-rise-youre-going-get-wet (Accessed 12.04.14)
9 "Climate in New Zealand" http://www.mfe.govt.nz/publications/climate (Accessed 23.06.14)

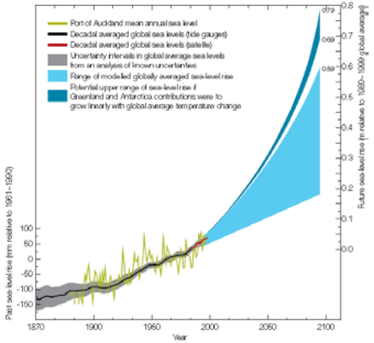


Figure 2.10 Graph of predicted sea-level rise.

Causes of changing sea level:

Sea level rise is typically a result due to a combination of the following five things[10]:

1. Ocean water expanding as it becomes warmer and less salty.

2. An increase in ocean mass as land-based glaciers and ice sheets melt

3. Dams, lakes, rivers and groundwater change are contributors

4. Regional variations in ocean temperature and circulation which cause local departures (positive or negative) from the global average.

5. Local land movements - The land can be stable, sinking or rising.

10 "Preparing for coastal change" http://www.mfe.govt.nz/publications/climate/preparing-for-coastal-change-guide-for-local-govt/html/page1.html (Accessed 23.06.14)

Strategies for Sea-Level Rise:

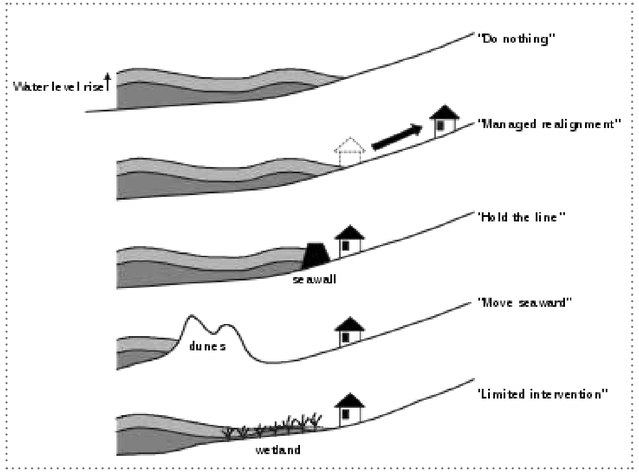


Figure 2.11 Diagram of strategies against sea-level rise.

Coastal Erosion.

Coastal erosion is one of the major influences of this project, as it directly affects the foundations of our buildings.

Together with sea level rise and increased severity in storms, many of our coastal areas are becoming subject to major erosion and are consequently too dangerous to build by. In simple terms, erosion is the retreat of the shoreline due to wind, waves, and water currents. Whilst these are natural processes, erosion can also be influenced and impacted by human activity and intervention. Many New Zealand beaches are prone to quick erosion, and if a series of storms occur within a short time frame, the effects can be severe and may take several decades to build up and restore.

Natural Erosion is affected by 3 major factors[11]:

1. Soil type and typology of land.
2. Wave type and wave height.
3. Wind direction and speed.

Before the storm, the waves are small, and the beach builds up as sediment moves onshore; whilst during the storm, the waves get higher and more frequent causing erosion to occur. After the storm, the calm down become less frequent, therefore the beach accretes once more.

There are two types of coastal erosion[12]:

1. Cut and fill erosion;

This type of erosion occurs on coasts which have loose sediment such as sand, shells and gravel. This loose and lighter material is freely moved by water action and therefore erosion occurs much faster here. Known as soft coasts, these are mainly beaches in the east coast region of New Zealand. The eroded material may be replaced over time, but certainly takes a lot longer than timespan of erosion.

2. Permanent erosion;

This type of erosion is more relevant to our west coast, where the breakdown of solid rock occurs due to constant pounding of wind and waves. This eroded material cannot be replaced.

11 "Te Ara, Coastal Erosion" Http://www.teara.govt.nz/en/coastal-erosion/page-1 (Accessed 15.04.14)
12 Ibid.

Figure 2.12 Coastal erosion leaving only structural piles remaining.

Material Deterioration.


Figure 2.13 Rust eroded frame.


Figure 2.14 Rust on boat tie.


Figure 2.15 Rust on Anchor.


Figure 2.16 Rust on ship wreck.

High winds, strong waves, dense rain and large tides are all typical elements of a major storm, and when all working together, can have a major effect on our built environments and structures as well as the landscape. Not only physically creating damage to structure by tearing, breaking and smashing building elements, but the coast has a major effect on the breakdown of the materials and their longevity. Salt causes decay, rust and erosion to materials and it becomes very difficult to create long-lasting buildings in such locations.

Because of these conditions, material choice becomes vital. Choosing a range of materials which resist decay and erosion and sustain the integrity of the structure such as timber and concrete will be essential in particular areas. However, it will also be applicable in this project to display how materials do erode and decay, showing how structures can become fragile and broken down in certain places. By simply using a range of materials, the user will experience both a feeling of safety and of concern as the different materials will be reacting in different ways to the environment – resisting and staying strong, and decaying in certain areas to display weakness. A juxtaposition of structures and experience.


Figure 2.17 waves crashing over road.


Figure 2.18 Boat washed onto footpath of Tamaki drive.

Tamaki Drive Storm 17.04.14

A recent example of nature's unpredictable power was experienced particularly on Tamaki Drive in Auckland City.

A location usually quiet, sheltered and calm was hit by a major storm earlier this year. Homes, shops and roads were covered in water with immense flooding causing property damage, loss of power and road closure. Unprepared and certainly not capable of resisting such storms, this was a good wake up call to our complacent attitude towards nature, and to our coastline. If we do not act soon, the combination of rising water levels, storms and unresponsive design will destroy our cities.

Figure 2.19 Home lost to Coastal Erosion.

2.2.2 Human Challenges.

This Section explores the relative challenges created by our Human relationship to the coastline. It explores our historical relationship, our physical relationship, and our psychological relationship to the coastline. Each of these sections holds an important role in breaking down the existing boundaries and challenges between the built and the coastal environment of New Zealand and how we as humans relate to the coast.

Each Section will be analysed pronouncing the challenges and underlying issues this project faces when dealing with us as humans, in relation to our coastline.

Historical Relationship.

Progression of civilisation has caused a change in our attitude towards the coastline. As we have moved into the industrial age, our reliance on natural energy diminished, and our greed for more created enormous stress on the natural environment. Moving from sail boats and ships which completely relied on wind and human power for main transportation, to planes and motor vehicles which rely on fuels for power, our connection to, and understanding of the power of nature and of the ocean has been lost. These large mechanical machines of which we have created give a sense that we have overcome the forces of nature. No longer is there an underlying respect for the danger of the coast and of the ocean as people are severely disconnected from it. It has become a cultural attitude issue, and it needs to be altered.

Early settlements naturally moved away from the coastal edge due to agricultural reasons; people understood coastal environment as harsh, dangerous and difficult to live by, and therefore would develop away from such areas. Villages and towns were built more inland and the only major developments by the coast were those which aided the ports for transportation of goods or people. However, in the current day and age this has significantly changed. A need for 'more' has created this culture which seeks to be as close to the waters' edge as possible, and it is been done without much or any respect for the power of nature and the dangers that occur at the coastal edge. Batches and buildings are now being built in places which simply would not have been considered safe or affordable to build on during early civilisation – and still should not be considered even in this current day and age. An arrogance has evolved into our culture; a culture which ignorantly thinks it can overcome the powers of nature due to our technological advancements.

By re-educating people of the implications of building in such locations, both physically and socially, this project aims to change people's complacent attitude and culture towards the coast which has developed over the last two centuries.

Figure 2.20 American Sailing ship.

Physical Relationship.

Re-establishing the physical boundary which stands between us and the natural environment.

"Architecture is a connecting link between place, climate and human life."[13]

The physical relationship we have to our natural environment, and in particular the coastline, needs to change.

Aldo Leopold, a famous American environmentalist speaks in his book 'His Life and Work, Wherefore Wildlife Ecology'; "Wilderness can give rewards and penalties for wise and foolish acts…against which civilization has built a thousand buffers."[14] As Humans, We have made many foolish decisions, in particular, when building by the coastline.

As humans, we are only capable of living in certain climatic conditions, and although we are surrounded by nature, we often find ourselves severely separated from it. We need oxygen, light, shade, controlled temperature and so forth, and therefore, we build in response to these ideal conditions. What we build, then allows us to reside in places and conditions of which would otherwise be impossible. However, in doing this we create a boundary to shield or expose our fragile bodies to the natural environment, often with little heed of the surroundings.

Spaces, materials, openness and closure are elements architecture uses to protect or expose us to the natural environment, but which often results in a boundary being created between us and the natural environment. These boundaries are an architectural intervention; an arrangement of materials designed to suit particular functions and purposes – to suit us as humans. Historically this is rarely achieved in a successful or sustainable way and evidently creates more disparity between built and natural. We are re-claiming land, using materials poorly and building non-beneficial structures on some of the most beautiful landscapes we have to offer. It is construction without thought, and in many situations, becomes destructive to the natural environment, not constructive.

Instead of shielding ourselves, we need to respond and reconnect in a more sustainable and beneficial manner, in a way which re-establishes and breaks down this boundary we have created.

We need to create through architecture a sensory impact which we see, touch and feel, re-connecting us with the natural coastline of New Zealand which will begin to break this barrier down.

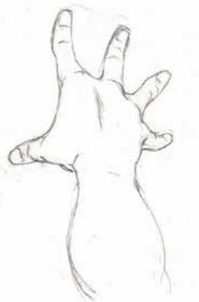


Figure 2.21 Sketch of arm reaching.

13 Torben Dahl. *Climate and Architecture*, (New York: Routledge, 2010) pg.13

14 Meine, Curt. *Aldo Leopold: His Life and Work, Wherefore Wildlife Ecology?,* (Madison:University of Wisconsin Press, 1988/2010).

Marine Pollution.

A fragile and complex environment, being destroyed by alien bodies which have been created by man. Marine pollution is becoming a serious problem which we as humans are completely responsible for. The majority of people are unaware of the affects they have on marine environments, and often, don't care at all. Educating people about the harm we are creating, and using simple methods which can dramatically reduce marine pollution becomes very necessary in this project. If action to remedy this situation is not instigated soon, many of our marine environments will soon be un-usable, and unrecoverable.

Land-based activities contribute to over 80% of marine pollution[15], and a significant amount of it begins from our built environment and buildings. The waste we produce on land eventually reaches the oceans, whether it's through runoff through drains and rivers or deliberate dumping. This human impact is causing a drastic effect on the marine environment, including marine life, and architecture can contribute either positively or negatively.

This pollution includes; Oil, Fertilizers, Garbage, non-biodegradable materials, Toxic Chemicals, and many more items[16].

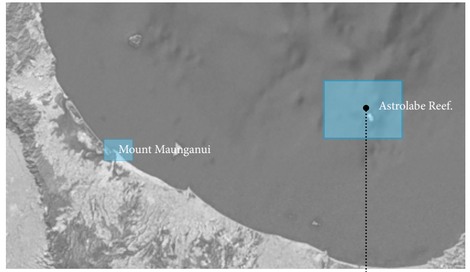
There have been many strategies created to help clean up marine pollution, however, these are only solutions which deal with the problem after the fact. This project aims to create awareness of these issues, before the waste makes its way to the ocean, so that it gets treated correctly.

15 "World Wildlife Fund" http://wwf.panda.org/about_our_earth/blue_planet/problems/pollution/ (accessed 28.06.14)

16 Ibid.

Figure 2.22 Child 'lifting' sea floor.
Figure 2.23 Surfing in marine pollution.

The Rena oil spill.



The Rena Oil Spill on Astrolabe Reef is a prime example of how our human actions have caused dramatic effect on the surrounding coastal environment. When the Rena ran aground in 2011, enormous amounts of oil was spilled from this ship into the ocean, causing catastrophic effects on both the coastal edges and many marine species.

Carrying 1,368 containers, 1,700 tonnes of heavy fuel oil and 200 tonnes of marine diesel oil, it was additionally carrying eight containers of which contained hazardous materials[17]. Enough oil was spilled to fuel a motor vehicle (car) for up to 79 years or equivalent to 2700 tanks of gas[18]. Killing an estimated 20,000[19] birds it caused complete devastation to New Zealand's Coast and its natural context. Within the range of where the oil spilled, is New Zealand's rare Spotted Dotterel bird and 25 other native birds' species inhabit; sadly many dotterels died due to the spill. In addition to this, 89 penguins died from oil coverage[20] which were recovered through the response.The pristine beaches of Mount Maunganui and other east coast regions were covered in oil for weeks. One outcome that is not yet determined is the effect the Rena oil spill will have on the ocean's ecosystems. Rob Zuur from the World Wide Fund for nature explains "It would take years to know the full impact of the oil spill on the Bay of Plenty's of ecosystems, which also contains huge marine kelp forests and is home to a large fishing industry".[21]

The reason the Rena Oil Spill is getting so much focus in this project, is because it will be used as an example of how devastating our human intervention to nature can be. It has been 3 years since the spill occurred, but we are still yet to see the real effects this disaster has on our eco-system.

17 "The Rena Oil Spill" http://www.counterspill.org/disaster/rena-oil-spill (Accessed 21.07.14)
18 Ibid.
19 "The Rena Oil Spill, a brief history" http://www.counterspill.org/article#/article/rena-oil-spill-brief-history (Accessed 23.07.14)

20 "The Rena Oil Spill" http://www.counterspill.org/disaster/rena-oil-spill (Accessed 23.07.14)

21 "New Zealand counts wildlife cost from oil spill" http://phys.org/news/2011-10-zealand-wild-life-oil.html (accessed 21.05.14)

An average of 600,000 barrels of oil a year has been accidentally spilled from ships over the past decade[22]; the Rena, is just one example of such disasters, and people need to be aware of how their everyday lives are having major effects on the surrounding eco-system.

22 "Ocean Facts" http://www.savethesea.org/STS%20ocean_facts.htm (Accessed 19.07.14)

Figure 2.24 Location map.

Figure 2.25 Rena disaster.

Figure 2.26 Man cleaning up oil

Figure 2.27 Bird Covered in oil from Rena

Figure 2.28 Rena stuck on Astrolabe Reef.

Creating an experience which completely immerses the occupant in the coastal environment, creating a personal response which changes their psychological attitude towards it.

There is an inner yearning for a deeper connection to the coast for many of us. Long walks along the beach often do more for our minds than for our bodies as it refreshes and allows for reflection and contemplation. An environment to which we strive to be near, is more often than not, quite the opposite in New Zealand. The 'image' we have in our minds of New Zealand's coast is often of calm sandy beaches where the sun shines and the water is clam, but this is often a misconception.

'Out of sight, Out of mind.'

This phrase sums up the general attitude many of us as humans have towards our natural and coastal environments. Although we strive to be as close to it as possible in a physical manner because we enjoy the environment, when it comes down to us thinking about the effects each of us have individually, it is much easier to put it out of sight, and therefore out of mind.

A new generation is being raised in New Zealand, and world wide - a generation without the knowledge, understanding and awareness of even the simplest of concepts about the relationship of our built civilisations to our natural surroundings. Some children these days are even un-aware where the food and produce they are consuming originates from. They often have no idea what the effects of their consumer driven lives are having on the ocean and coastal environment. Re-establishing this relationship becomes a major challenge of this project, as it aims to not only re-connect physically, but mentally with the occupant. The architecture needs to generate a complete sensory impact which effects and changes people's attitude towards the coast forever. This impact needs to be driven into the minds of those experiencing it so deeply that it cannot be forgotten. This project seeks to educate people through complete immersion, changing the mindless, and blasé psychological attitude which currently exists.

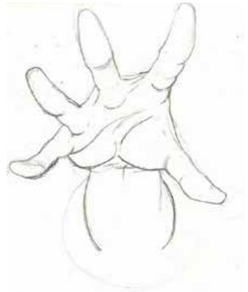


Figure 2.29 Sketch of hand reaching towards.

The Concept behind changing a persons' inner psychological attitude will not be simple. Many people cannot grasp how fragile the world we live in is, or how fragile we as humans are without being in the safety of the controlled environments we have created; therefore, finding a mechanism which will trigger this understanding becomes vital in the success of this project.

Perception and understanding are two elements of human nature which are triggered by watching and observing. In the book 'The Biology of Civilisation: Understanding Human Culture as a Force in Nature', Boyden (Author) identifies that people don't need to be participating in an activity to receive satisfaction from it;

"*Enjoyment [for humans] can be experienced both directly, participating in various activities …. and vicariously, by merely observing other people doing these things. Or it can be achieved even more vicariously by observing such activities on the television screen or by reading about them in the newspaper*"[23]

It becomes clear that in order for people to gain an understanding, it can be as simple as providing an opportunity for them to observe.

However, providing a solution people can be a part of is very important also. Research has shown that desired behaviour change is more successful when people are made aware of the problem and also a way to solve it. In an article, written by Futerra Sustainbility Communications, 'New Rules, New Game', it explains in relation to changing human behaviour; *"Until people feel on the inside that changing their behaviour will make a difference, no amount of information, price cuts or haranguing will bring about the change needed"*[24]. If people can see themselves becoming part of the solution, it creates a sense of empowerment and the 'new' attitude or behaviour is more likely to become routine. Applying these theories in an architectural development will aid complete awareness to be achieved.

23 Stephen Boyden. *The Biology of Civilisation: Understanding Human Culture as a Force in Nature.* (Sydney: University of New South Wales Press Ltd, 2004) 71.

24 "New rules: new game" The Rules of the Game. Futerra sustainability communications. (London: Futerra, 2005)

2.3 Strategies.

This section is addressing strategies the project will apply in response to the challenges mentioned above, with particular focus on; Education, Awareness and Care/Sustainability. These strategies will then be developed as an architectural response, using mechanisms which create awareness and understanding of the issues relative in this project.

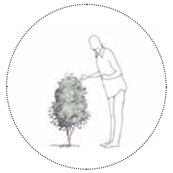
2.3.1 Education.

Through education, you create awareness, which leads to care.

People absorb information differently, and it becomes clear that there needs to be more than a billboard with ten thousand words on it to create understanding that the coastline is both dangerous, and in danger. These issues need to be experienced in a way which solidifies the coastal dangers into people's minds and changes their attitudes and therefore treatment toward it forever. It is through experience that people will become educated and aware of such issues. This section briefly explores various methods explaining how humans absorb information differently, and then creates a framework which will be applied to the architecture.

Education

Education



Awareness

Care

Education Mechanisms.

Understanding how humans learn and absorb information becomes extremely important. As mentioned above in the psychological relationship section, we as humans absorb information differently, and therefore this project needs to address many different learning methods. Some people are kinaesthetic learners or social leaners, whilst others learn by being spoken to or by repetition; we are all different. Finding methods which will ensure the information is absorbed and understood universally becomes very important. Below are the seven typical methods of learning[25]:

1: Visual (Spatial) – Preference to using pictures, images, and spatial understanding.

2: Aural (Auditory/musical) – Preference to using sound and music.

3: Verbal (Linguistic) – Preference to using words, both in speech and writing.

4: Physical (Kinaesthetic) - Preference to using body, hands and sense of touch.

5: Logical (Mathematic) - Preference to using logic, reasoning and systems.

6: Social (Interpersonal) - Preference to learn in groups or with other people.

7: Solitary (Intrapersonal) - Preference to working alone and use self-study.

This project aims to create awareness and understanding of our relationship to the coast, therefore the architecture will need to embrace all seven of these learning mechanisms. Translating these learning methods into architectural elements becomes a driver of the project and will begin to control the layout and the architectural language used in the project. Using different sized spaces, sounds, logical mechanisms, social areas and areas of solitude will all come into play to create a complete sensory experience, ensuring that awareness and understanding is achieved to most people groups.

For analysis, the seven learning methods have been arranged into groups, which have similar attributes.

These groups all have similar qualities, which can be addressed in an architectural manner.

These spaces created will touch the inner depths of a person's emotions and will play a part in creating a permanent change in attitude towards the coastline.

25 "7 Styles of learning" http://www.edudemic.com/styles-of-learning/ (accessed 06.05.14)

Analysis - Architectural Translation.

Group 1:

Visual (Spatial)

Physical (Kinaesthetic)

Logical (Mathematic)

This group is about what you see, feel, touch and the mechanics behind the spaces.

Reliant on visuals, these spaces will translate the ideas through elements such as light qualities, materials, movement and structure.

Group 2:

Verbal (Linguistic)

Social (Interpersonal)

This group is about information absorption through group discussion.

The architecture will create experience predominantly through the ability to discuss, or read information as a group.

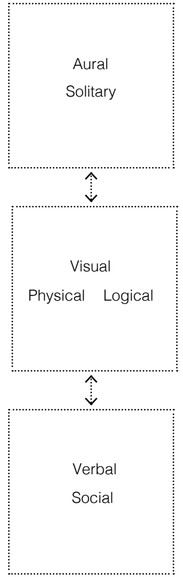
Group 3:

Aural (Auditory/musical)

Solitary (Intrapersonal).

This group will utilize the sounds of the context, and explore the sizes of the space to allow for interaction at different levels of intimacy.

Exploring silence, and loudness to create the atmosphere; these spaces will touch the inner depths of a person's emotions and will play a big part in creating a change in attitude.



2.3.2 Care / Sustainability.

As part of creating awareness to the implications of building by the coast, this project aims to educate people of how we can build in a sustainable manner around the coast. The way in which we respond to the natural environment becomes extremely important. The Sun, Wind, Tide and Rain are all elements which have a huge effect on our coastal environments, but which also have the potential to provide self-sufficiency at such locations. They can allow the coast to be both pleasant and dangerous. Ensuring that the way in which we design has a positive influence on our coastal environment is a considerable part of this project. Finding and using mechanisms, technologies and knowledge which allows sustainable design becomes important and will provide a firm foundation for our future generations. Utilising the sun, wind, tide and rain in combination with new technologies and materials will ensure that the facility is a positive contribution to the coastal environment, and to our planet as a whole.

This section will break down each of the major natural elements, and explore how various methods will allow this project to become as self-sufficient as possbile; including creating energy, to dealing with waste completely on-site and in a passive manner.

Figure 2.30 World in palm of hands.

Solar.

The Sun has the ability to dramatically change the way our world operates. It's proximity to the earth determines everything from temperature to weather patterns and it has the potential to provide vast amounts of energy of which this project aims to utilize. Capturing the sun through photovoltaics and similar technologies will be implemented to create energy, as well as using passive design methods to heat and cool the structures.

Figure 2.31 Diagram of Sun.

Wind.

The Wind can be one of the most devastating natural elements on this earth. It brings and takes away storms, and has the ability to both create waves, and calm waves. The wind is also a great energy source which needs to be taken advantage of. In addition to solar energy, wind energy has the potential to be captured through turbines and will be applied if necessary.

Figure 2.32 Diagram of Wind.

Tide.

The Tide is a consistant movement of water, and has the ability to generate huge amounts of Energy. Although this potential energy is very predictable, it does become challenging to utilise, and is very site specific. If applicable, this project will aim to integrate the tide through design to both create energy, and create awareness of its power.

Figure 2.33 Diagram of moon.

Water Collection.

Although widely acknowledged and often treated as an afterthought, rain water collection is essential for the future in design and construction. This project aims to collect and re-use as much rain water as possible to ensure that the facility operates in a sustainable way. Utilizing passive filtration methods, much of the rain water collected can be re-used to reduce water consumption on the project, and even aid in the treatment of wastewater.

Figure 2.34 Diagram of rain.

Wastewater treatment.

This project aims to become a self-sufficient facility to showcase how coastal design can have a positive effect on the environment. Treatment of waste can be done on-site using various methods – including passive methods. Integrating the natural context into the project in a way which showcases and explains passive sustainability as a logical and successful possibility.

A Wetland system will be applied to this project to display a successful and passive design strategy to treating waste water on-site. Integrating the wetland system into the architecture offers a valuable educational opportunity, showcasing how such systems work. It will allow the general public to view the process of the waste treatment and observe that it can be done in a sustainable, and beneficial manner for both humans, and the surrounding natural environment.

Some advantages of using a wet land water treatment system are[26]; - Reliability

- Low energy

- Year-round operation, even in cold climates.

- Smaller footprint required.

This project will have to take into consideration factors such as soil type, slope and the surrounding environment to ensure this system operates at its best, and is the correct position on the site.

26 "Constructed Treatment Wetlands" http://www.epa.gov/owow/wetlands/pdf/ConstructedW.pdf (Accessed 26.06.14

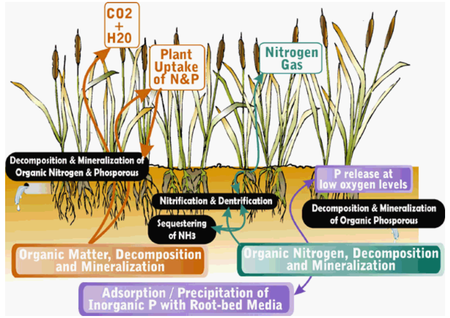


Figure 2.35 Sketch diagram of Wetland Waste water system.

Figure 2.36 Analytical diagram of Waste water system.

Figure 2.37 images of Installed Westland system.

2.3.3 Static vs Dynamic.

Built form, or in this case architecture, is a static object. It sits grounded on its foundations and more or less, withstands nature's elements. It is designed to stand firm, solid and grounded, and through this, give its occupants shelter from the exterior environment.

On the contrary, the natural environment (the context in which this static architecture sits), is anything but static. It is dynamic and is constantly moving, shifting, opening and closing, eroding and accreting. It is this dynamic movement around the static structures which is causing the issues. The foundations to which the built structure is grounded upon is not at all static, and soon, if poorly realted to the coastal site and if the foundations are unstabel, the structure will be slipping off the edge to destruction.

A lighthouse is purpose built architecture with a specific function. It is designed to withstand anything that nature throws at it; from strong winds and huge waves, to heavy rain and material decay due to the effects of salt build up. They are a prime example of a static, resistant architecture.

A sailing ship on the other hand, is extremely dynamic and adaptable. It opens and closes its sails to capture wind, and it moves with the dynamic movements of the ocean. It is light, and adaptable and has worked for centuries. It gets beaten up, and repaired because it can. The aim of this project is to expose the building and allow it to be both static and dynamic in its response to the forces of the coastal environment.

Instead of only creating static architecture which withstands nature's movement, the architecture also needs to respond and adapt with natures movement. Instead of being only resistant, like a lighthouse, the architecture also needs to be adaptable, as a ship is.

Figure 2.38 Light house at Portugal in storm.

Figure 2.39 Artist impression of ship in storm.

Figure 2.40 Lighthouse at San Esteban De Pravia, Spain in storm..

Figure 2.41 Artist impression of Ship in storm 2.

2.4 Precedents.

It is important to explore both positive and negative examples of buildings / structures which exhibit similar qualities as to which this project is aiming to achieve.

Exploration into both Static and Dynamic buildings will be analyzed for this project as reference. Static examples being buildings, which exhibit functional requirements and which withstand and resist the surrounding environment. Dynamic examples alternatively being examples, which encapsulate the feelings, emotions and atmospheric qualities of the coast, and which respond in a more adaptable manner than the static.

This project seeks to examine both the static and the dynamic aspects of such projects and combine these qualities into a symbiosis of the two. A combination of both static and dynamic elements is required for the project to have a true influence.

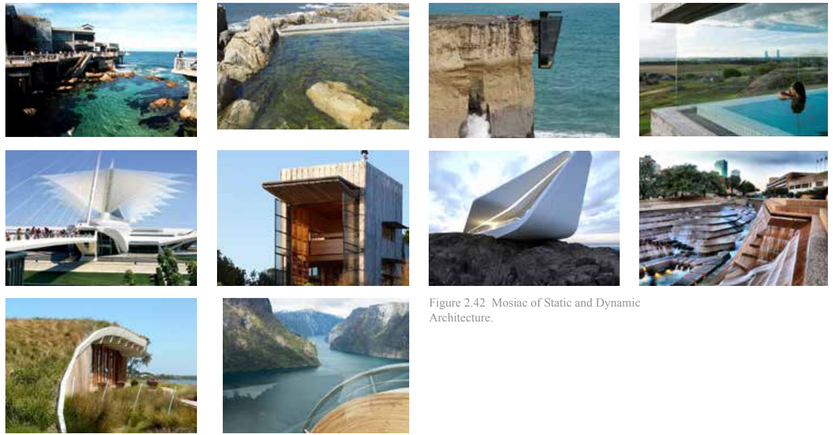


Figure 2.42 Mosiac of Static and Dynamic Architecture.

Figure 2.43 Hut on sleds external 1.

Figure 2.44 Hut on sleds external 2.

Figure 2.45 Hut on sleds external 3.

Figure 2.46 Hut on sleds external 4.

Figure 2.47 Hut on sleds external 5.

HUT ON SLEDS
- Crosson Clarke Carnachan
- New Zealand

This project is a good example of a dynamic architecture. It is designed to both open and close up against the elements. Resting on two thick wooden sleds, it has the ability to be shifted to the back of the beachfront section[27]. Innovative and portable, it is a dynamic response to the ever-changing landscape of the coastal environment in which it stands.

Negatively, the hut is weakly connected to it's context, and it would be great to see this dynamic ability, be more integrated with its surroundings.

27 "Hut on Sleds" http://www.ccca.co.nz/projects/hut-on-sleds (accessed 04.05.14)

Figure 2.48 Cliff house image 1.

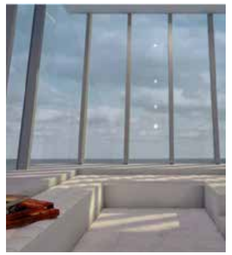


Figure 2.49 Cliff house internal 1.

Figure 2.50 Cliff house internal 2.

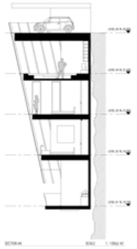


Figure 2.51 Cliff house section.

Figure 2.52 Cliff house image 1 large.

CLIFF HOUSE BY MODSCAPE
- Concept
- south-west coast of Victoria

Inspired by the way barnacles cling to the hull of a ship[28]; this concept was developed as a natural extension of the cliff face, rather than the surrounding landscape. The idea was to create absolute connection with the ocean, and it certainly would achieve that. The structure is anchored into the cliff face subtly which adds to the suspense of the project, but certainly would eventually collapse into the sea.

With constant exposure and vulnerability, this 'house' would create a considerable impact on ones emotions and possibly change their attitude towards the coast.

28 "Modscape Clff house" http://modscape.com.au/cliff-house-by-modscape-concept/ (Accessed 18.05.14)

Precedent 3 - Static .

Figure 2.53 Leca Swimming pool

Figure 2.54 Leca Swimming pool 2

Figure 2.55 Leca Swimming pool 3

Figure 2.56 Leca Swimming pool 4

Figure 2.57 Leca Swimming pool 5

LEÇA SWIMMING POOLS
- Alvaro Siza
- Portugal, 1966

Used as a precedent for it's successful integration with the natural surroundings, this pool complex was built in the 1960's[29]. Although it is a very static complex, it successfully allows the dynamic movement of nature to be seamlessly intertwined with its program.

Creating the ability for the user to freely experience both built and natural form with seamless connection enhances the users experience. It is this integration, which makes it very successful.

29 "Leca Swimming pools" http://www.galinsky.com/buildings/leca/ (accessed 21.07.14)

Precedent 4 - Static and Dynamic.

Figure 2.58 Milwaukee Art Museum 1.

Figure 2.59 Milwaukee Art Museum 2.

Figure 2.60 Milwaukee Art Museum 3.

Figure 2.61 Milwaukee Art Museum 4

Figure 2.62 Milwaukee Art Museum 5

Milwaukee Art Museum
- Wilsconsin, U.S.A

Static and Dynamic, this building by Calatrava[30] presents both a beautiful interpretation of natural elements and a dramatic structural response to changing environments. The structure allows a movable, wing-like 'brise soleil' which opens during the day and closes down over night or during rough weather and then acts as a shield – similar to the wings of a bird.

It is a great example of making something beautiful, also functional.

30 "Milwaukee Art museum" http://mam.org (accessed 23.05.2014)

Figure 3.1 View down Tamaki Drive towards city.

3.0

Design Part One:

Initial Developments:

This section became extremely important in the development of this project. Beginning with designing in response to the natural elements, 'Design part one' explores form and its ability to become functional in response to these elements. Through a series of design decisions, it allowed the programme to be clearly defined and articulated to draw conclusions which have pushed this project further than originally expected.

Condensed, this section briefly explains a design process which lead to significant changes in the project. These changes have allowed more precise research in relation to the original research question. It includes explanation of the original site selection and its parameters, and design options in response to the site and to the research question.

3.1 Initial Site.

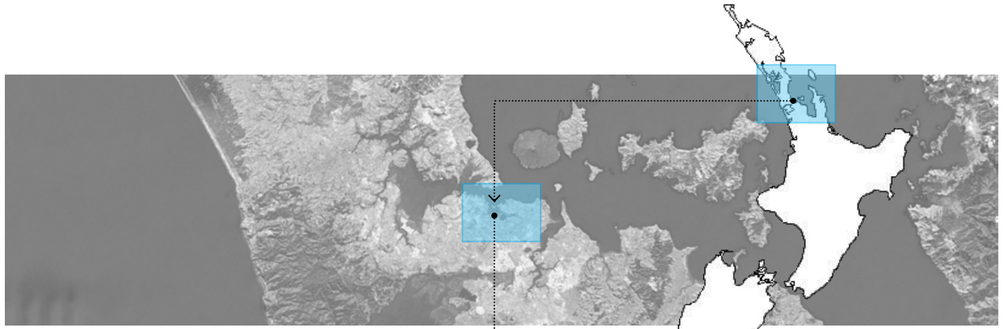


Figure 3.2 Site location map.

Initial Site:

The initial site selection influenced the design in ways which lead to a resilient architecture. In addition to this, site factors majorly undermined the main focus of this project.

Site choice was driven by various original requirements which would aid creating awareness of the relationship between built and coastal environments. These included; exposure to natural elements, exposure to public, and accessibility. Together, these requirements naturally determined a location within close proximity of Auckland CBD.

Hobson bay.

Auckland CBD:

Auckland sprawls over an isthmus between two harbours: the Manukau and the Waitemata. With 1.47 million, Auckland's population is expanding very quickly and claims a major portion of New Zealand's population.

Urban Auckland has hundreds of kilometers of coastline, in fact a total of 1,613km. Most Aucklander's live within 5 kilometers of the sea.

Figure 3.3 Auckland Location map.

Figure 3.4 Site photographs 05.04.14

Initial Brief.

Education.

The primary aim of this project is to educate both New Zealand's public and tourists of the effects our built environment is having on out coasts. It requires to provoke knowlege which will lead to future results in a sustainable pattern.

- Respond
- Adapt
- Deflect
- Reflect
- Refract
- Sustain

Adaptation.

The aesthetics of the buildings and spaces shall respond and adapt to the changing coastal environment displaying the relationship of our built environment to the coast.

For example: It shall be obvious at all times how the facility is responding to physical elements such as the wind and tide , both from the exterior and interior of the project.

Function.

The project will include spaces and facilities which allow for;

- Education
    - Interactive
    - Observative
- Research
    - Environmental
    - Technical
- Power generation
    - Wind
    - Solar
    - Tidal
- Water Collection
- Water Purification
- Office work
- Marine work
- Boat repair and workshop
- Observation

Tennants.

The facility will encompass a range of tennants which will ultimately work together to form a coherent symbiosis of function.

- D.O.C
- Auckland yacht club (in place of the Auckland Motor boat club
- Auckland Transport
    - Rail
    - Motor Vehicle
- Genisis Energy

Infrastructure.

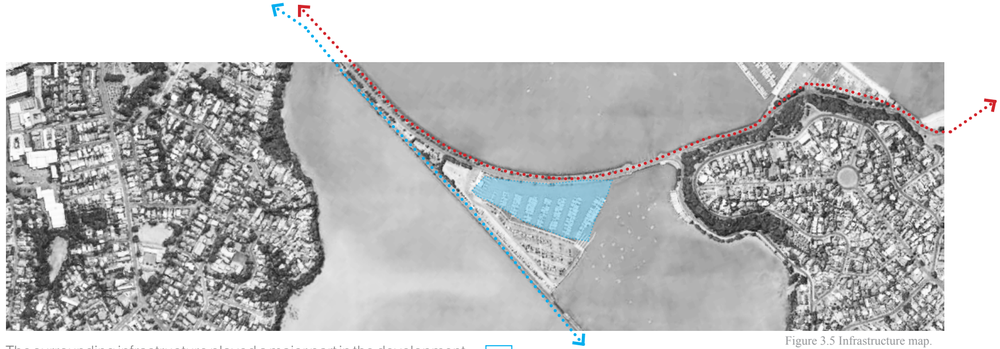


Figure 3.5 Infrastructure map.

Rail.

Motor Vehicle.

Marina.

The surrounding infrastructure played a major part in the development of the following designs as it gave the project immediate parameters and constraints to work around. Subsequently, these constraints became a major focus, drawing attention away from the main research question.

These constraints include;

- Railway, which runs at various times, seven days a week.

- A very busy four-lane road connecting to the CBD

- A small powerboat marina, involving access in and out at various times of the day.

3.2 Design option 1.
The Wind Tunnel.

This design option was focused on creating an architectural response to the wind. Creating a form, which manipulates the wind to both reduce the stress on the building, and create energy through capturing the winds power through wind turbines.

The result was design, which became a static object, resilient against the wind and typical coastal conditions. It was not adapting to changing wind directions as it was designed predominantly around the NE and SW prevailing winds.

The design also incorporated tidal movements, and utilized the predictable movements of the ocean to create energy through the use of turbines.

The design focused on;

Adaptation:
To changing wind directions and strengths.

Mitigation:
Of wind on structure and surroundings.

Resilience:
Against strong winds, reducing damage on structure and surroundings.

Maximization:
Of wind and tidal movement to create energy in an efficient, sustainable manner.

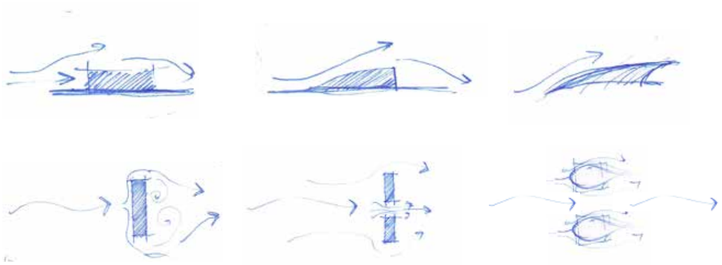


Figure 3.7 Sketch of wind resistance on forms.

Figure 3.6 Proposed Design option one on site.

Figure 3.8 Proposed Design option one on site, showing wind tunnel and tidal interaction.

3.3 Design option 2. Wings.

Figure 3.9 Bird in flight.

Reflecting Calatrava's Art museum, this design option was driven by investigating a more adaptable mechanism; the natural movement and adaptability of a bird.

The ability to open and close their wings serves as both a mechanism, which allows the bird to fly, but the birds' wings also act as a shelter for its body.

In flight, a bird is constantly adapting its wings and feathers to get maximum use of the wind to create flight. It is this movement and response to wind that inspired this design option.

This design was more focused on;

Adaptation:
To changing wind directions and strengths.

Mitigation:
Of wind and waves against structure and surroundings.

Resilience:
Against strong winds, waves and future predictions of sea-level rise.

Maximization:
Of winds power through form, to create energy in a sustainable manner.

Plan.

SE Wind.

NE Wind.

W Wind.

The Horizontal;
- Horizontal elements in this design are aerodynamic to reduce wind resistant and the building footprint is a translation of the wing. Lifting the building off the ground with a structure allows for sea level rise to have minimal effects on the use of the building

The Vertical;
- Shifting floor plates create dynamic movement allowing the building to move and respond to what the wind is doing, reducing the stress on the building. In an effort to make this project as sustainable as possible, the Marina housing powerboats (which emit harmful gases and pollution), would be altered to integrate Eco-friendly design - sail boats.

The main issue was the logistics of the sailboats, which have high masts. A lock-system was designed to allow the boats to travel over top of the road in a sealed canal. This however, began to distract from the research question, as it became a major focus of the project.

Figure 3.10 Model photographs.

Figure 3.11 Exterior image of design, showing integration with Marina

Figure 3.12 Interior image of boat lift / internal space.

3.4 Design option 3. Sails.

Figure 3.13 Elevation of Yacht.

This design option was driven by investigating a man made structure, which is adaptable in a similar manner to that of a bird - A Sail Boat. Sail Boats have been used for centuries to travel the ocean, and are designed to deal with strong winds, big waves and high levels of corrosion.

Much like a birds wings, the sails of the boat open, close, and even change direction depending on what the wind is doing. When it is calm, the boat opens up its sails to capture as much of the wind as possible, creating movement.
In the same way, this design was focused on capturing the wind through the buildings forms, and creating energy from it.

Translating the concept of adaptability is what was driving this design.

Adaptation:
To changing wind directions and strengths.

Mitigation:
Of wind and waves against structure and surroundings.

Resilience:
Against strong winds and waves, reducing damage on structure and surroundings.

Maximization:
By using the form of a sail to capture the winds power and transform it into energy.

Conceptual Models.

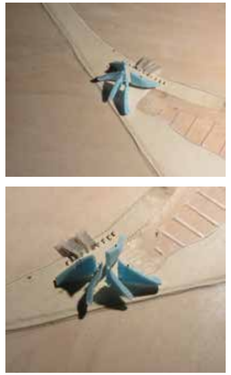


Figure 3.14 Preliminary Sketch models.

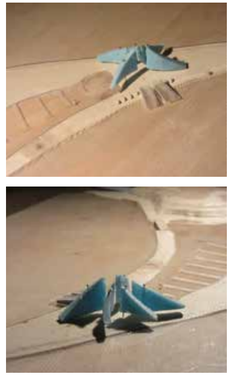


Figure 3.15 Developed design sketch models.

This concept was focused on creating a statement, enhancing public awareness of the facilities sustainable mechanisms. Derived off the form of a sail, the wind would be funneled into turbines, which would then power the building. The integration of the sailboats from the marina passing over the road would enhance this notion and provide complete awareness of the facilities focus.

The verticality of the design gives it presence in the context, whilst the wide spread forms of the sails integrates the entire surrounding infrastructure including the road, rail and marina.

Figure 3.16 External image of interaction with water - sunny day.

Figure 3.17 External image of interaction with water - in a Storm.

2.5.3 Conclusion. Design Part one.

A critical analysis:

It has become clear through the above design options, that due to constraints attached to the site (such as roads, railways and marina) the real focus of the project had been lost. Upon reflection, this project is not actually about creating a solution to building by the coast (How to deal with sea level rise, erosion and storms because this has been done for generations and really, is only specific to the site or area to which the building is placed), but it is about creating awareness of the issues, and showcasing the natural elements (wind, tide, swell, floods, rain) and their effect on our structures.

This project needs to become a complete SENSORY impact. A holistic experience of what you see, hear, smell, feel, temperature etc. to evoke a complete understanding of the coastal conditions. Like putting people on the bow of the Titanic – the project needs to invite people to experience the forces which are upon the boat or which are destroying our buildings - create a change in thought and respect to how we are designing on the coast, and not just provide a solution or response which may only be specific to one site.

Much like how you can give a man a fish, and feed him for a day; or you can give a man a net, teach him how to fish, then you feed him for a lifetime - This is what this project aims to do. Not provide people with a solution (for that solution may only be relevant to that specific buildings' site and its functions), but to provide people with understanding of the forces of nature on our coastlines so that when they go to design their own Building by the coastline, they are aware of its exposure and the dangers which are apparent in such places and therefore, ultimately design with accordance to their new understanding. The focus of this project needs not to be so much about researching ways to stop erosion and sea level rise (and other coastal conditions), but it becomes about educating people of the dangers and the consequences of building in such places which are subject to these conditions.

This leads to a building which physically responds to the forces of nature in a way which showcases nature's power and destruction on the coastline. It will become a mixture of structural types - places which are hard, solid and withstand these elements, and also places where the structure might break down and actually become damaged. Places where those experiencing the building WILL get wet, where the tide will be coming in and out and showing people what is happening. Parts of it will need to move / shift / fold / change / bend in order to show natures forces and create awareness and respect through education and understanding.

Figure 4.1 Water moving between Rocks.

4.0

Design Part Two.

Architectural Developments:

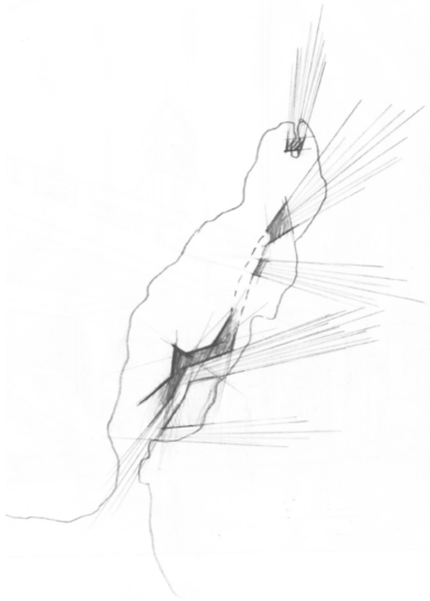
This section begins to tackle the challenge of creating awareness of the coastal issues through architectural forms and expressions.

It explores ways in which the physical and psychological relationship we as humans have to the coast can be exposed through architecture. It explores how the architecture will interact with the land, the water, and with People to create a hollistic design.

In Response to Design Part One, It has drawn upon a site change. This change in site will allow the project to answer the research question in more depth and create an intellectual design response.

This section begins to explore the mechanisms which will be used to create awareness and understanding of the main issues of this project through architecural interventions.

Figure 4.2 Preliminary design sketch



4.1 The Site.

Figure 4.3 Location Plan.

Mount Maunganui:

Dense coastal development ensures this location will provide the necessary environment for this project. Tauranga city's population is growing exponentially, with many new schools and educational facilities.

Moturiki Island - Mount Manuganui.

Figure 4.4 Arial Photogragh of site.

Moturiki Island:

An outcrop of rocks off the main beach of Mount Maunganui called Moturiki Island. It has a long history of previous developments, the island now lies once more as an un-touched piece of landscape, allowing the public to explore the rocks and gain access to the water's edge. Stretching out from the beach, this section of rocks sits very exposed to the elements. NE winds and waves often attack this landscape with vigour and it becomes a very lively piece of land. It will allow this project to take advantage of such conditions, creating a sensory experience of the coast.

This site will allow the project to take advantage of such conditions, creating a sensory experience of the coast.

Marineland/Leisure Island.

In 1966 Marine Land Ltd built an aquarium on this site. From 1967[31] it was home to a variety of marine mammals as well as chimpanzees, llamas, wallabies, kea, possums and ferrets.

More than a million people passed through its gates in the following 15 years. The Marine Mammal Protection Act bought into passing in 1978, which meant the park had to get a permit from the Ministry of Fisheries to continue operating. Along with funding issues its closure was inevitable, and the park closed in May 1981[32].

Owner Peter Sorrenson then applied to Mount Maunganui Borough Council for a water park and in September 1981, Mount Maunganui Leisure Park opened. The leisure park operated until 1990 when it was removed from the island.

31 "The New Zealand Herald" http://www.nzherald.co.nz/bay-of-plenty-times/news/ article.cfm?cid=1503343&-objectid=11055963 (accessed 18.08.14)
32 "Maori Pa Sites" http://econtent.tauranga.govt.nz/data/documents/plans/reserve_management/mt_maunganui/background.pdf (Accessed 14.08.14)

Figure 4.5 Moturiki Island in the 1960's pre-development.

Figure 4.6 Moturiki Island in the 1970's showing Marine Land.

Figure 4.7 Moturiki Island Leisure Island.

Figure 4.8 Moturiki Island Leisure Island pools.

Figure 4.9 Moturiki Island Leisure island pools 2

Figure 4.10 Moturiki Island Marine land, seal.

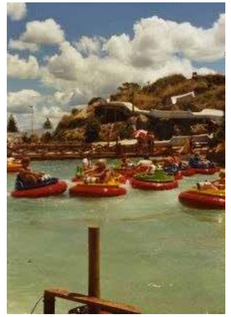


Figure 4.11 Moturiki Island Leisure Island bumper boats.

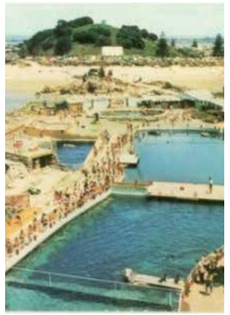
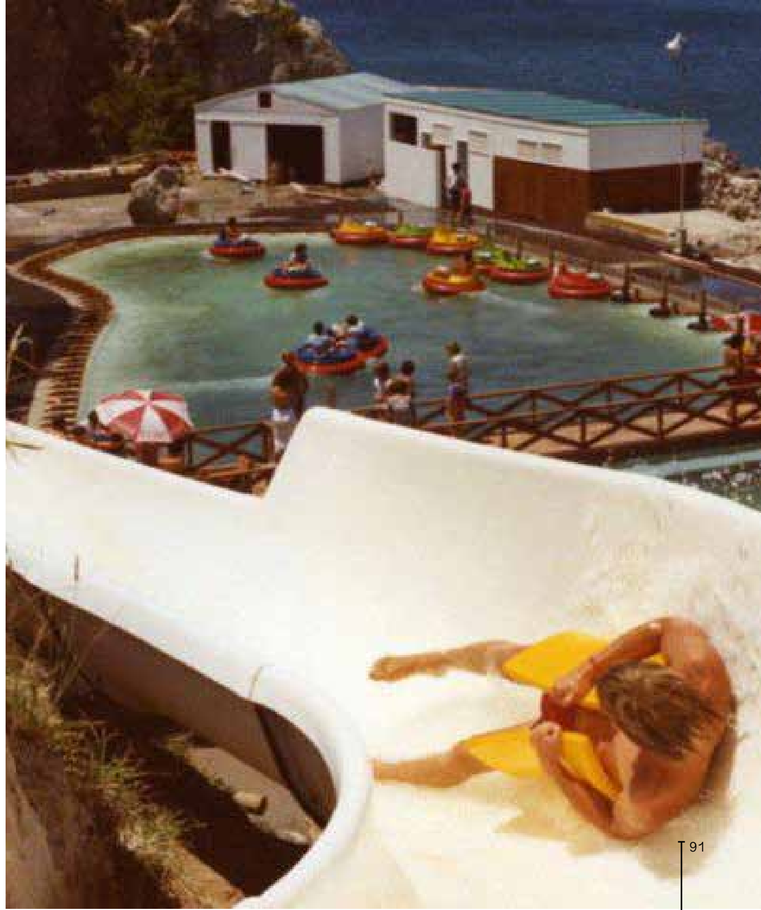


Figure 4.12 Moturiki Island 1970's development and pools.

Figure 4.13 Moturiki Island Leisure Island slide.



Maori Significance.

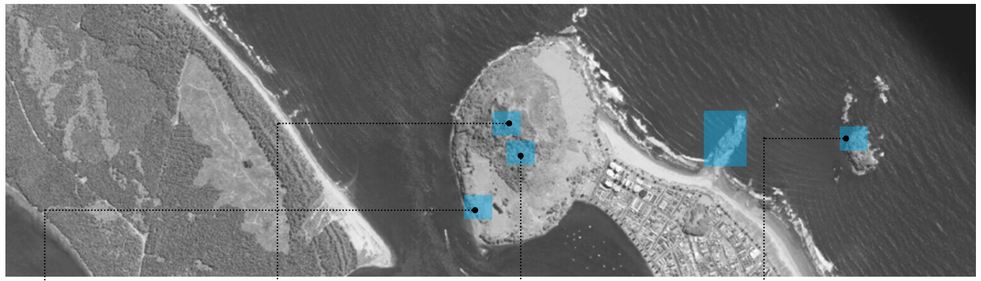
Figure 4.14 Arial Map of Mount Maunganui

Figure 4.15 Arial view of Moturiki Island from Mount Maunganui.

Maori Significance[1]:

It is important to understand the surrounding cultural significance of such a profound piece of land, therefore a quick exploration into the Maori significance follows.

1 "Maori Heritage and Pa information" http://www.heritage.org.nz/the-list/details/6401 (Accessed 18.08.14)



Kinonui Pa:

Located on the western side of Mt Maunganui, the site is spread over the knoll at the northern end of the small beach on the public walkway west of Pilot Bay.

Mauao (Mount Maunganui):

The reserve management plan notes: 'Mauao remains today immersed in the poetry, waiata, chants and history of its onetime Maori occupants and, as in the past, it is still a most revered and respected landmark, containing the traditions and mana of its Maori people'.

Pa:

The Ngaiterangi people suffered a severe defeat here at the hands of the Ngapuhi in 1818, and there appears to have been no significant Maori occupation of the area since that time. Early European visitors to the area noted the extensive terracing of the hill, and the dense middens.

Hopukiore, Moturiki, Motuotau and Te Toka o Marutuahu:

The wahi tapu area is located on the seaward side of Mount Maunganui on Marine Parade. Two roads meet Marine Parade, Grace Avenue and Pacific Avenue. Hopukiore is located between these two junctions. Moturiki, Motuotau and Te Toka o Marutuahu are all located on the foreshore directly adjacent Hopukiore.




Figure 4.16 Moturiki Island on a Beautiful Sunny day.

Note that there are no waves and no wind which results in a very calm and peaceful area - This is quite the contrast in a storm.




Physical Analysis.

This section investigates the physical attributes of the site analyzing the contours, sections and public paths to explore where this project will be best located on the site.

The main focus of course, is the immediate site, Moturiki Island, and gaining an in-depth understanding of its relationship to the coastline.

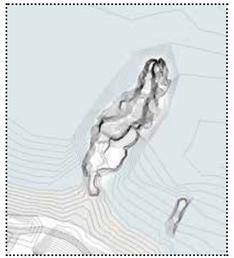


Figure 4.17 Site plan in contet.

From water level, Moturiki Island reaches a maximum height of 23m, and runs approximately 400m in length to the N NE. Covered in vegetation there is a subtle connection between compact solid rock and soft natural greenery.

Moturiki stretches from the land with a mixture of steep and low-ling topography, creating various areas for different levels of interaction.

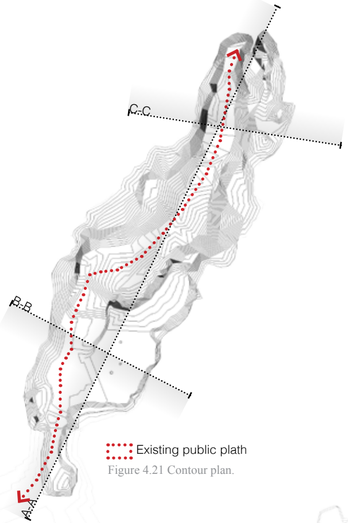


Figure 4.21 Contour plan.

Figure 4.18 Existing Long Section A-A.

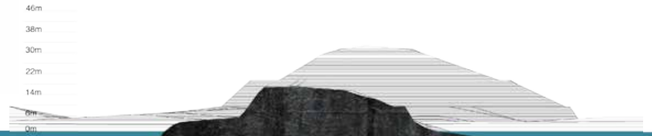


Figure 4.19 Existing Section B-B

Figure 4.20 Existing Section C-C

Figure 4.22 “The Blowhole” Exploding with water.

Site Activity - The Blowhole.

Figure 4.23 “The Blowhole” Showing waves crashing and exploding into the small inlet between the rocks.

As the site exists, it is well respected by the local people of the area. Ensuring that the landscape is respected is very important, and this project will have to be careful of respecting the surroundings.

The Blow -hole at the far North East end of Moturiki Island becomes an integral part of the site. Swells surge between a small gap between two rock outcrops which creates a lively interactive zone. Exploding swells surge in and out of the rocks and is a display of the oceans power as it meets the shoreline.

4.2 Master Planning.

Figure 4.26 Public Path.

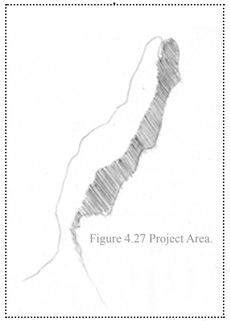


Figure 4.27 Project Area.

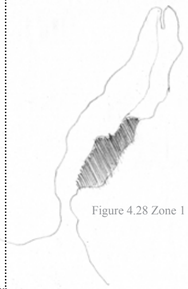


Figure 4.28 Zone 1 - Static

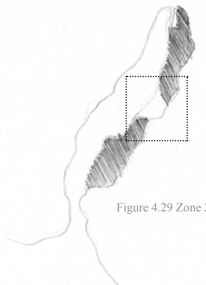


Figure 4.29 Zone 2 - Transition.

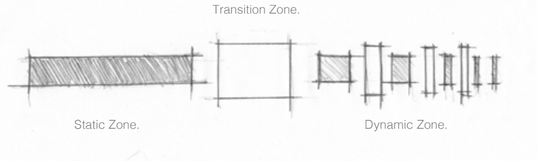
Figure 4.30 Zone 3 - Dynamic.

Figure 4.31 Sketch diagram showing relationship between the Static and Dynamic Zones.

The following sections plays a significant role as they establish the projects boundaries. Breaking down Zones 1, 2 and 3 of the site by applying programme, functions and materials to each of these zones. The Functions will relate back to the research and be focused on creating awareness of sea level rise, erosion and marine pollution through use of the educational methods mentioned in section 2.3.1.

The project becomes an experiential journey, beginging at the 'static' zone (zone 1), and ending at the 'dynamic' zone (zone 3). Through this journey, those experiencing the spaces will become educated of the coastal conditions through a range of mediums. Each zone will explore the material types and their connection to water and to land, the openess or closure of the space, and the emotive responses the the user gets from the experience.

Maintaining a separation from the existing public path is important to respect the landscape, and to reduce distraction from public activity for those experiencing



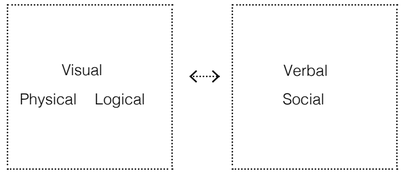
4.3.1 Design - Zone 1: Static.

This area is solid, grounded and reflects the qualities of the lighthouse mentioned earlier in section 2.3.3, as more of a resistant architecture. It becomes the main 'hub' of the project as it involves the majority of the functions.

The architecture in this zone becomes grounded and connected to the landscape. Its integration with the existing landscape will create a sense of belonging and safety against the coastal environment.

In addition to using visual, aural, logical, verbal and physical education methods mentioned in section 2.3.1, this zone becomes focused on a social environment. It will allow opportunity for discussion and interaction, therefore giving personal ownership and understanding of the concepts that will be taught.

In this 'Static Zone', the information about the coast - sea-level rise, erosion, pollution and destruction is given in factual form, explaining through lecture-style, or verbal explanation and interaction. The 'Experience' of these issues occurs in the 'Dynamic Zone' (4.2.2).



Programme:
Coastal Awareness Center.

This zone is about educating people of the concepts of the relative coastal issues - sea level rise, erosion and marine pollution.

Collaboration between the Department of conservation (D.O.C), 'Coastal Zone Management Authority and Institute' (CZMIA). Water Safety New Zealand, and Local Council drive this project and become the main tenants. These three parties all have the same goal in mind – they want to reduce the risk at on the coast, both for humans and our buildings, and for the environment. Schools, tourists and public will come to this facility to gain in-depth understanding of the coast, therefore, certain functions must be applied.

Vital programmes:

- Entry
- Reception / Waiting area
- Toilets: male/female
- Changing areas: male / female
- Storage: personal/facility.
- Offices: D.O.C, CZMIA and Water safety NZ
- Maintenance
- Services

Education Programmes:

Marine pollution education

- Erosion education
- Lecutre theatre with 100seats
- Sea level rise education.
- Pool for water safety NZ
- Pool for marine recovery (D.O.C)

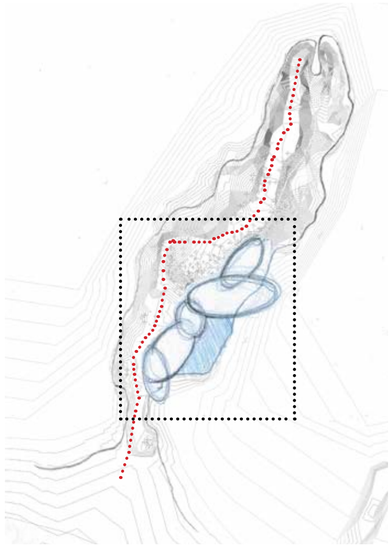


Figure 4.33 Initial diagram of static programe layout.

Materials:
The materials used need to reflect the 'static' concept of this zone, therefore; strong, solid, and well-grounded materials will be used.

Similar to the swimming pools by Alvaro Siza (Precedent 3, 2.4), Concrete will ground the architecture and set the framework for the spaces, whilst steel, timber and glass will help embed the facility within the landscape.

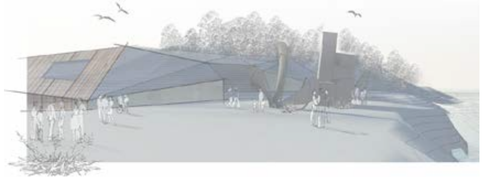
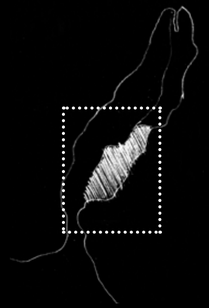


Figure 4.32 Initial image of 'Static Zone'



Zone 1 - Static.

Master Planning and Massing.

Simple bubble diagrams help to organize the programs and establish the relationship each has to the other. This 'Static Zone' embodies the majority of the programs, and it is important to locate them appropriately.

Beginning with the entrance, the relationship between the existing landscape and public path is maintained without disruption to reduce the impact on the site to the public users. From here, the facility leads into the vital programs of the facility such as the reception, toilets and changing areas, and storage. These become necessary for the facility to operate and are located within this static zone as there is less risk of them being disrupted by the harsh coastal conditions as this section of the site is well protected. It then will follow a natural progression through the education areas eventually leading on to 'Zone two'.

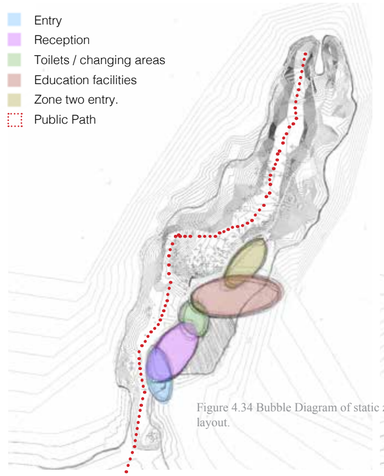


Figure 4.34 Bubble Diagram of static zone layout.

Figure 4.35 Formalizing bubble diagram of static zone.

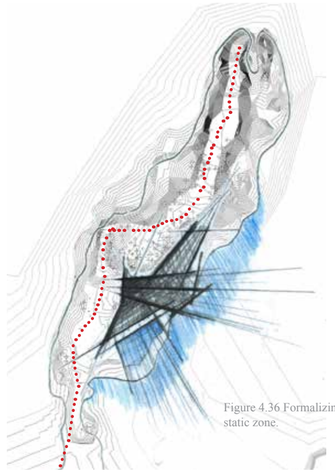


Figure 4.36 Formalizing organisation of static zone.

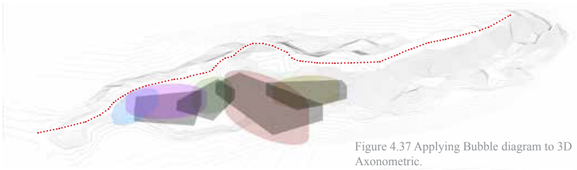


Figure 4.37 Applying Bubble diagram to 3D Axonometric.

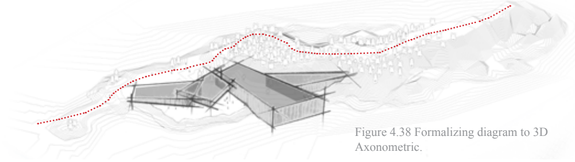


Figure 4.38 Formalizing diagram to 3D Axonometric.

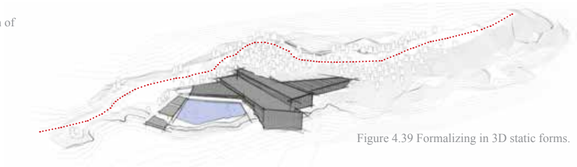


Figure 4.39 Formalizing in 3D static forms.

Zone 1 - Static.

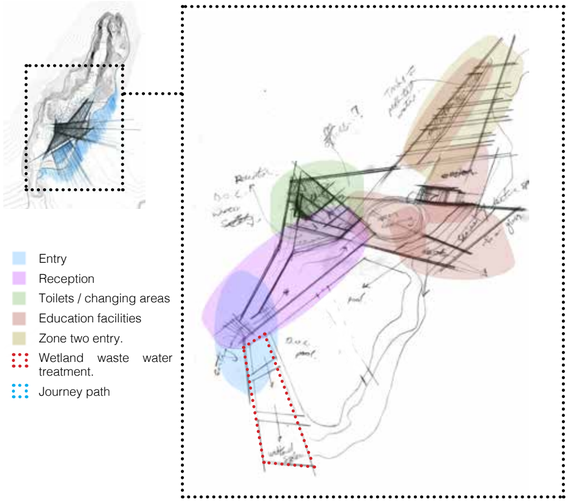


Figure 4.40 Formalizing programme layout of static zone.

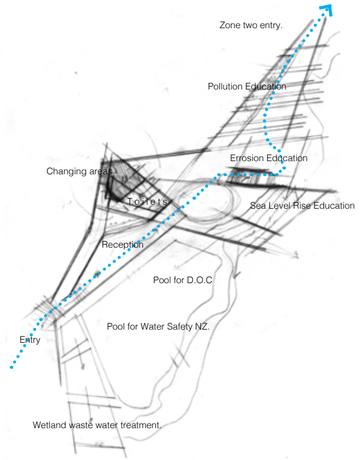


Figure 4.41 Formalzing - make more architectureal

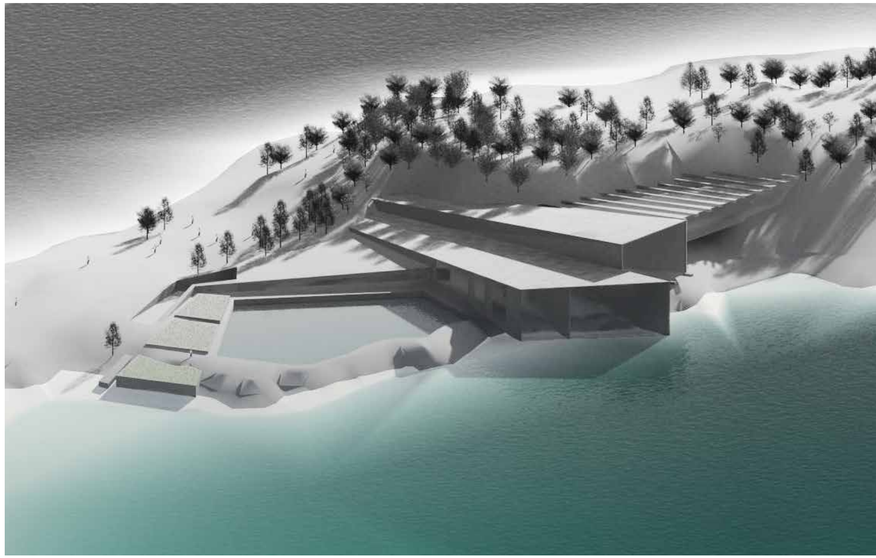


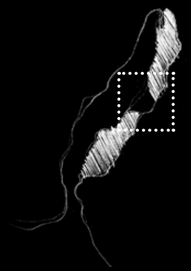
Figure 4.42 Arial Image of static zone

Figure 4.43 Arial image of static zone 2

Zone 1 - Static.

Figure 4.44 Internal perspective of Sea level rise edcation theatre.

Figure 4.45 External perspective of static zone



Aural
Solitary

4.3.2 Design - Zone 2: Transition.

This zone is very important as it creates a break between Zone 1, and Zone 3 (static and the dynamic). It is important for these two spaces to have a separation in order to cleanse the mind, and not be overloaded with information. Much like eating bread between wine tasting to clear your pallet, this space acts as a cleanse for the mind, creating refreshment and separation before the dynamic zone.

Playing with light and scale, this transition zone becomes quiet and enclosed. Moving from large, light and open spaces in Zone 1 to smaller, darker spaces will help change the atmosphere, and begins to break away from the social activity in Zone 1. This darker, smaller space plays a role in separting the social experience from the solitary experience, much like two lanes of traffic merging into one, people will naturally separate and create more distance between them. The business of moving from a social situation to a solitary experience is very necessary before zone 3 begins, and will be achieved by simple strategies including proportions of height to width and light and darkness.

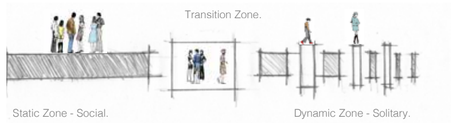


Figure 4.46 Static and Social, Dynamic and Solitary.

This zone plays off the landscape to enhance the users feeling of connection to the envrionement. As this zone is focued on refreshing the mind, and allowing for reflection of zone 1, it is important to have minimal distractions in this zone.

Utilizing the steep surrounding cliff edges, this zone pierces into the landscape completely closing the user off from the exterior coastal environment. A sense of confinement and solitude wil be created by completely removing the user from the context. All visual connections to the external context will be removed, and only audial connection will remain. This removal allows for complete refreshment between zone 1 and zone 3 and enhances the sudden exposure which occurs in zone 3.

Materials:
The materials used in this zone will be subtle and aimed at blending in with the context to reduce distraction.

Timber will form the structural elements, whilst the existing rock from the landscape will line the walls. In addition, light will be softely integrated to create and enhance the atmosphere.

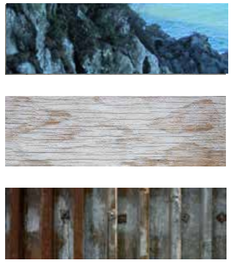


Figure 4.47 Materials in static zone.

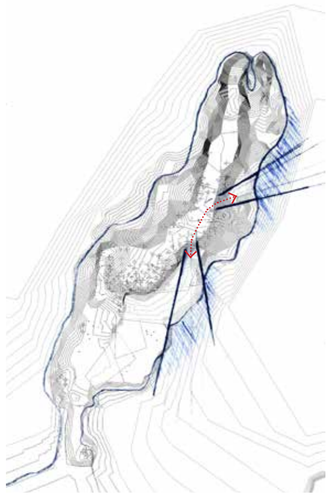
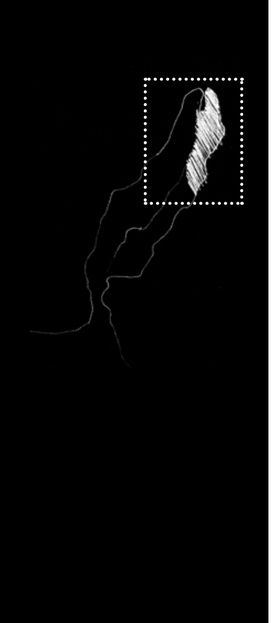


Figure 4.48 Plan diagram of Transition zone.

Figure 4.49 Internal perspective of Transition zone.



4.3.3 Design - Zone 3: Dynamic.

Reflecting qualities of the Ship mentioned in section 2.3.3, this zone is where the 'experience' of the project begins. Acting as a more adaptable architecture, it responds differently from zone 1.

Instead of being grounded, solid and resistant, this zone is lighter and less perminant than Zone 1. Similar to the 'Hut on Sleds' design, or the 'Cliff house by Modscape, this zone is about creating understanding through experience. What was learnt through lecture-style spaces, or verbal explanation in Zone one, will now be physically experienced to create a complete sensory understanding of the coastal issues.

In reference to Section 2.3.1 on education methods, this zone becomes more of a solitary experience and is focused on creating a personal change in attitude towards the coast. It is only at this stage, that the information taught in Zone one will be given real meaning and understanding on a personal level. This Zone aims to get rid of the 'Bystander effect'; "everyone else knows about it, so someone else will do something... right?", and create a personal level of responsibilty which will change the way each of us acts towards the coast.

This Dynamic Zone, will expose people to the true forces of the coast, at times making people feel un-safe, and insignificant in comparison.

Programme:

The programme in this zone becomes more intimate, and more flexible than Zone 1. It becomes a journey of spaces which progressivly become more interactive with the landscape and with the coastal elements such as the wind, waves and tide. The journey explores openness and closure, connection to landscape and to water, and through this educating people of the coastal conditions through an interactive experience.

It starts to explore how the structures can respond to the wind, waves and tide and how movement and physical interaction can be expressed on a more intimate level.

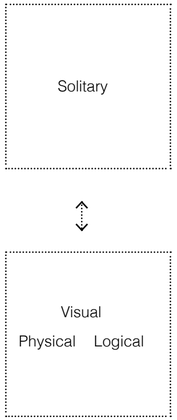


Figure 4.50 General layout of Dynamic Zone.

Materials:

The materials used in this section will be a progressive change from solid, stable and non-corrosive (Such as concrete and timber) and evolve into lighter, less stable and more susceptible to corrosion from the coastal conditions.

In addition to concrete and timber, materials such as Steel, Core10 and glass will be used to show the destruction the coast can cause on our buildings.

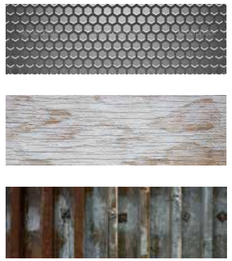


Figure 4.51 Materials used in Dynamic Zone.

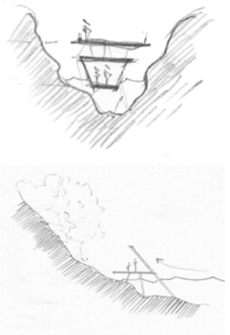


Figure 4.52 Sketch Sections of possible intteraction methods.

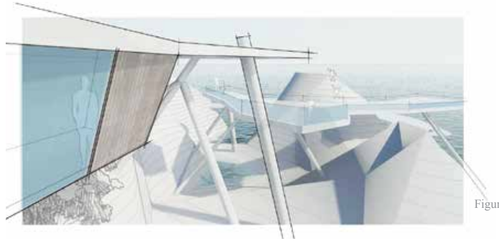


Figure 4.53 Initial image of dynamic zone.

Zone 3 - Dynamic.

Master Planning and Massing.

This Zone gets broken into smaller sections which are dedicated to specific coastal conditions including the wind, the tide, and the power of waves.

- Stage 1 : Wind Interaction.
- Stage 2 : Transition 2.
- Stage 3/4 : Water interaction. Transition 3.
- Stage 5 : Waves interaction.
- Public path.

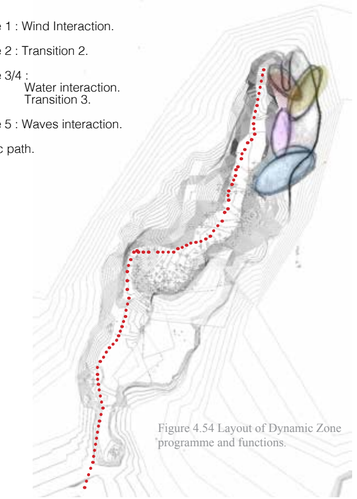


Figure 4.54 Layout of Dynamic Zone programme and functions.

Stage 1: Wind interaction

The first stage of this dynamic journey is the connection between this dynamic zone, and the previous Zone 2 (transition zone). Due to the dark, smaller and enclosed space of zone 2, the high contrast of being suddenly exposed to the exterior environment will be very powerful. Wind is one of the main drivers of harsh coastal conditions as it creates waves, leading to land erosion and other challenges mentioned in section 2.2. Therefore, the wind will be the first element you interact with on this dynamic journey. Facing directly to the North East, the strong winds in storm conditions will come straight into this wind zone and really expose the user to the power of nature. The Forms used will help capture this power, anad funnel it into the space for enhanced interaction.

Stage 2: Transition 1

This stage acts as a secondary transition area, reconnecting you to the landscape, and partially closing you off from the external coastal environment. Semi protruding the edge of the steep bank, there will be a sense of suspense as you journey down toward the water, only getting small visual snippets of the exterior environment. This section of the journey is touching on your aural sensors, and becomes a completely solitary experience. Refer to Figure 4.55 for internal perpective of journery towards water

Stage 3: Tidal/Water interaction

Aimed at creating interaction with the water and tide, this stage of the journey is focused on kinaesthetic, visual and audial sensors. As Stage 2 meets the water level, a sharp turn will expose once again the exterior environment, and you are now standing at eye level with the water. Until this moment, connection to the water has only been through audial and visual sensors, and now allows kinaethetic and touch to be actived. As the tide moves up and down, this narrow passage will change from being wet to dry, and at moments my be a struggle to pass across if the waves are rough enough. This stage really begins to emmerse the user with the water and creates physical understanding of its power.

Stage 4: Transition 2:

With a similar function of stage 2, this transition stage is about showcasing the coasts ability to corrode materials and exhibit the destructive forces of the coastal environment. Using materials which break down easier such as untreated steels, the path becomes weaker and less inviting to journey across. It is also important that this stage maintains minimal visual connection to the final stage which finishes at the blowhole. This is to enhance the experience at the final stage of the journey.

Stage 5: Waves interaction – Blowhole.

Throughout this dynamic journey, visual and physical connection to the waves has been maintained at a minimal. The final stage of the journey then becomes a complete immersion in the forces of the coastal injecting the user into the blowhole area. Suspended above the waves as they crash into the rocks, the user will feel the water crashing up towards them. This zone is wet, windy, and to some degree dangerous, concluding in a complete sensory experience, creating indepth understanding of the forces of the coast.

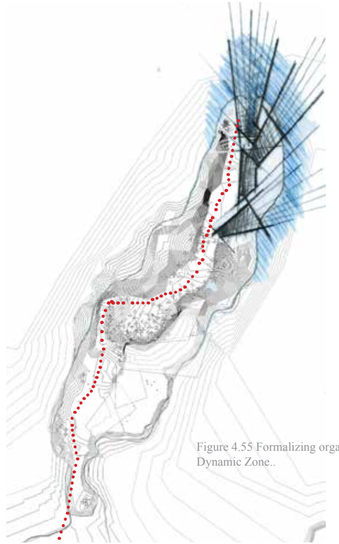
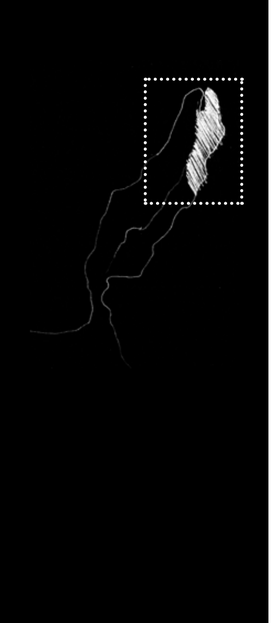


Figure 4.55 Formalizing organisation of Dynamic Zone..



Zone 3 - Dynamic.

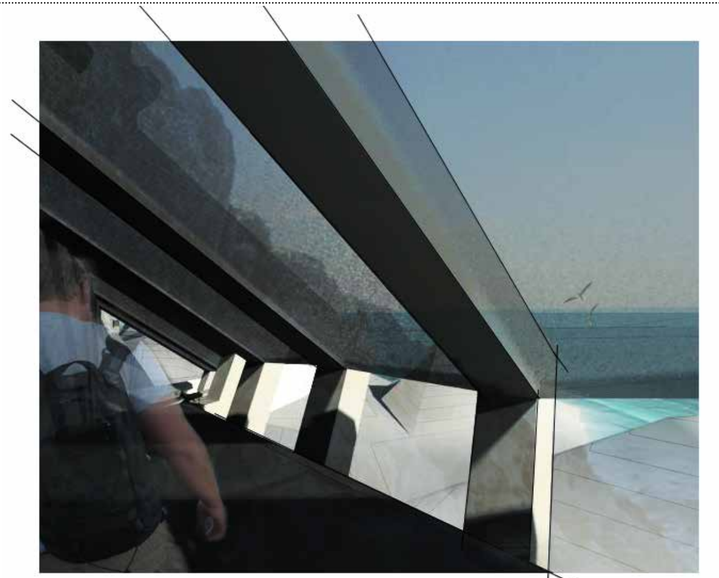


Figure 4.56 Perspective of stage two - Transition 1.

Figure 4.57 Perspective of stage 3 - Water Interaction.

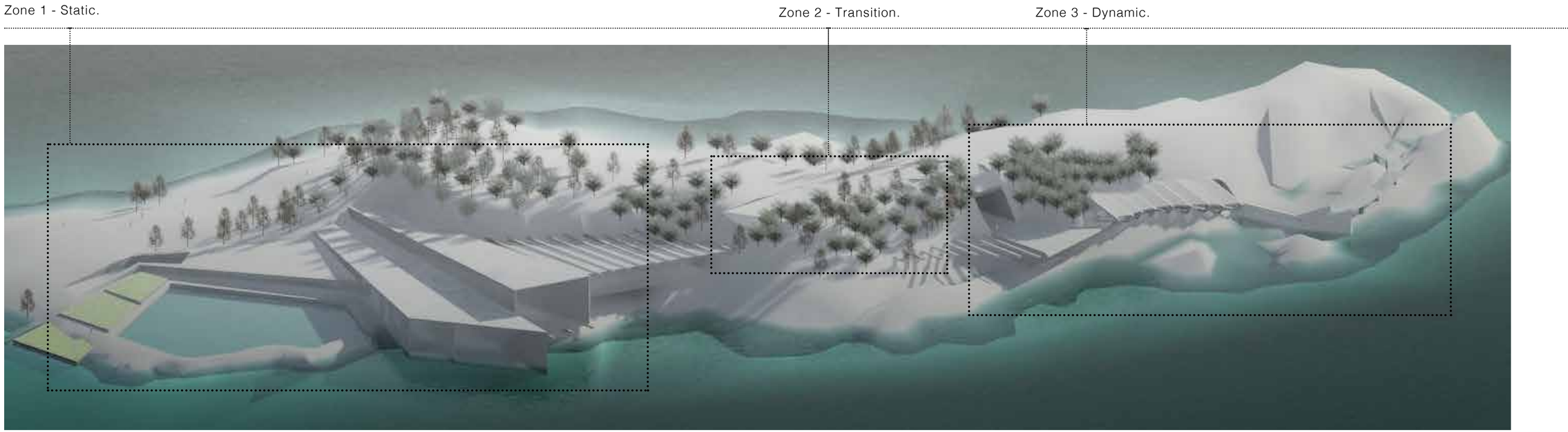


Figure 4.58 Complete Scheme identifying the three zones.

Figure 5.1 Waves Crashing on Moturiki Island.

5.0
Design Solution.

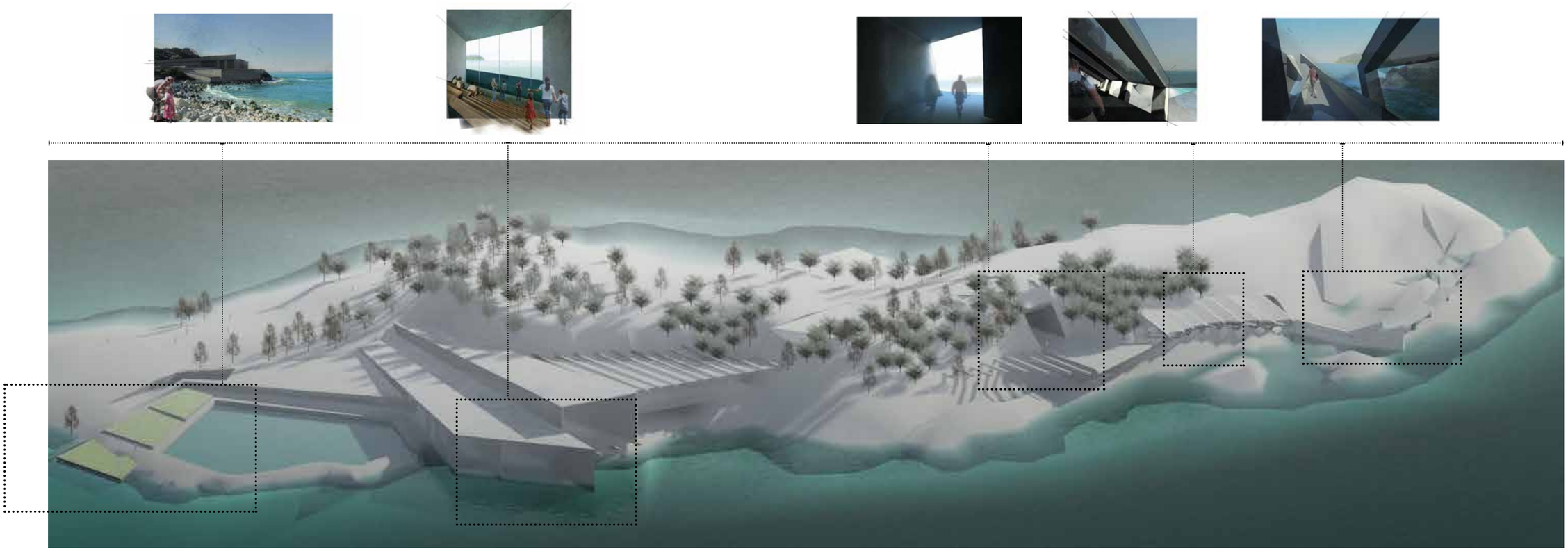


Figure 5.2 Complete Scheme on Moturiki Island.

Figure 6.1 Eroded concrete on Moturiki Island.

6.0

Conclusion.

This thesis explored how architecture can be used as a mechanism to create awareness and understanding of the challenges related to the coastal environment of New Zealand, reestablishing a more respectful attitude towards such environments.

Analysis arrived at the conclusion that comprehensive awareness and understanding might be achieved by the impact of a holistic human sensory experience generated by the wind and waves on the chosen site. This used the contrast between static and dynamic architectural devices, to help create a near comprehensive sensory experience. Shelter vs. exposure and stability vs. movement are contrasted with one another, reinforced by the notion that we as humans are insignificant in comparison to the power of nature. Personal response to the challenges of such environments is achieved through a sequential journey, which engages with the natural coastal environment (wind, tide, waves) and the human sensorium.

The level to which the human sensors (what we see, hear, touch, smell and taste) and the educational methods (how we absorb information; audial, visual, verbal, kinesthetic, logical, social and solitary) have been implemented can be used to determine the success of such an architectural intervention on our attitude towards the coastal environment.

Given that this project is only completed on a theoretical level, it is uncertain as to the long-term affect this facility would have on the attitude of people towards the coastline. Future research would explore how this facility could be implemented on a full-scale level of physical completion.

Figure 7.1 Pipe protruding into water, Moturiki Island.

7.0

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Figure 8.1 Close-up of rocks on Moturiki.

8.0

Appendix A.

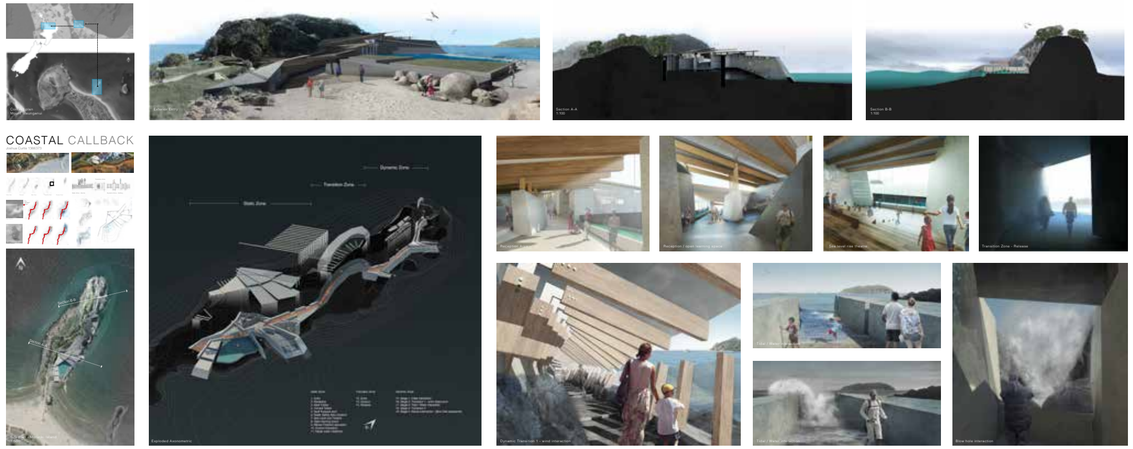
List of Figures.

Figure 8.2 Waves crashing on Moturiki (Mount Maunganui in background).

9.0

Appendix B.

Final Presentation Drawings.



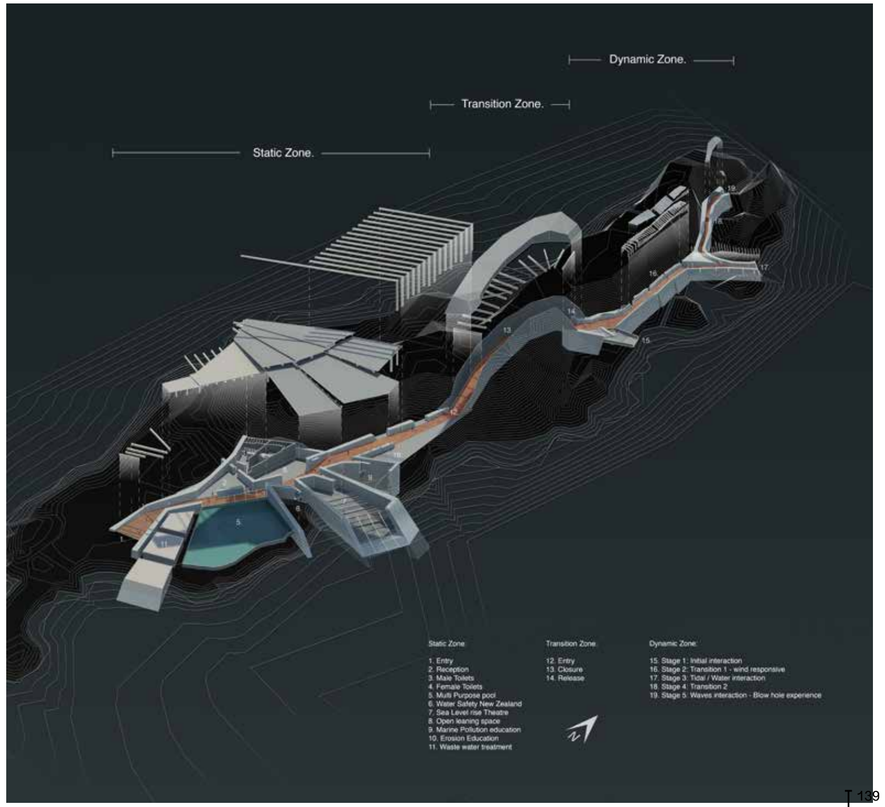
Above: Final Presentation as on wall.

Left: Final presentation with examiners in foreground.

Above: Site plan of Moturiki Island.

Right: Exploded Axonometric.

Next spread: exterior image of facility entrance.



Above: Static Zone - Internal perspective of reception area.

Above: Static Zone - Internal perspective back at reception area / circulation spaces.

Above: Static Zone - Section A-A.

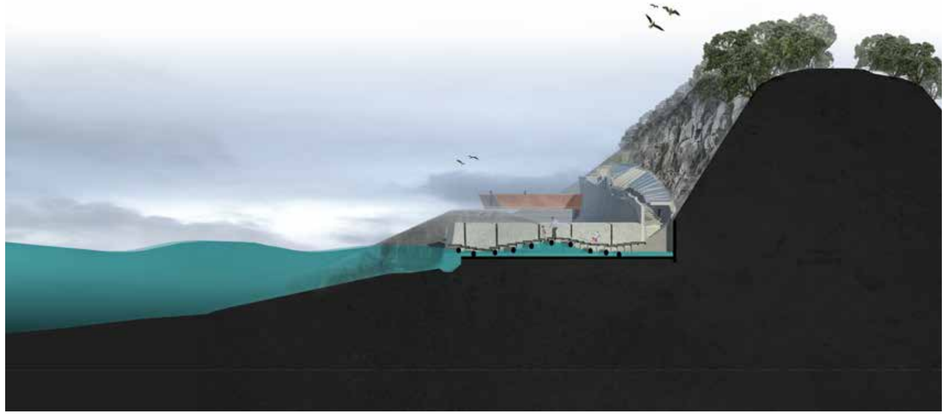
Above: Static Zone - Sea level rise Theatre.

Above: Transiton Zone - showing ‘compression / Release’ before Dynamic Zone.

Above: Dynamic Zone - Wind interaction walkway.

Above: Dynamic Zone - Tidal Interaction area - Calm and sunny situation.

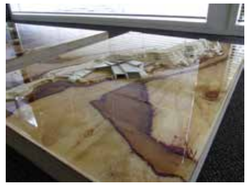
Above: Dynamic Zone - Tidal Interaction area - Rough and stormy situation.

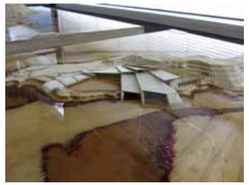


Above: Dynamic Zone - Section B-B - Tidal Interaction area.

Above: Dynamic Zone - Blowhole interaction - Final Stage of journey.

Above: Model Photos -Context plan @ 1:2500 - Plywood / Resin.





Images: Model Photos - Site plan @ 1:500 - Plywood / Resin.

Above: Model Photo - Both Models side by side - Plywood / Resin.

Above: Complete Presentation as on wall.